Consulting Engineer

July 1960

Photo by Fabian Bachrach

ALFRED H. SAMBORN, senior partner in Samborn, Steketee and Associates, Otis & Evans, Toledo, and chairman of the Functional Section for Consulting Engineers in Private Practice of the National Society of Professional Engineers, believes professionalism begins in the individual consultant's office. His firm has gone to considerable expense and trouble to put these ideals into practice.

Continued on Page 13

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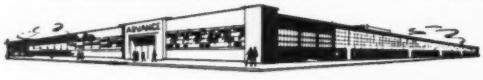

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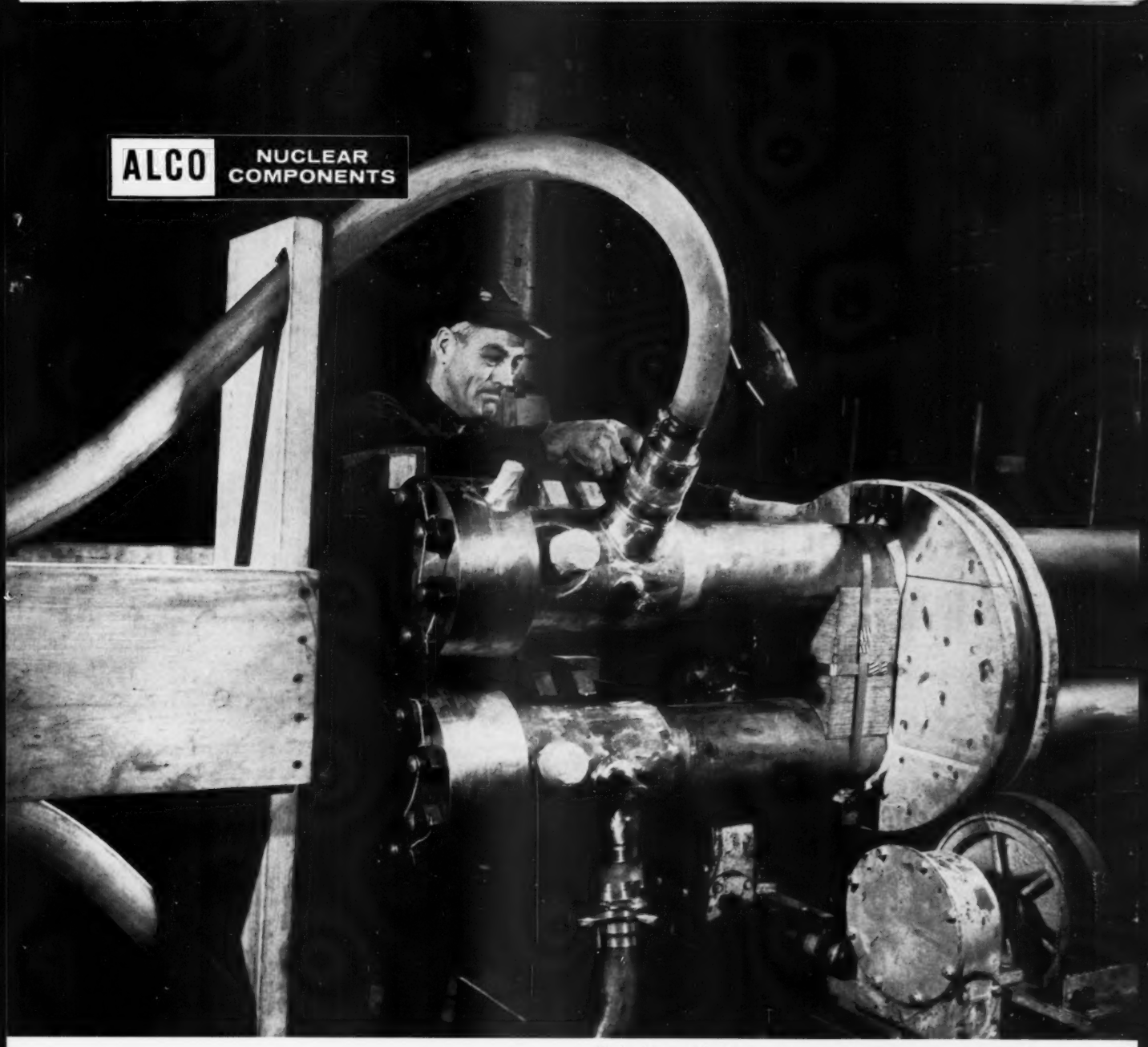

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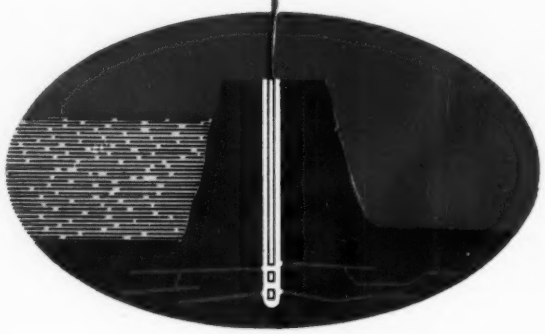

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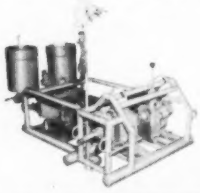

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JULY 1960 • VOLUME XV • NUMBER I

ARTICLES

86 Can the Construction Contract Cover Detail Engineering Costs?
Warner Howe

89 Italy's Highway to the Sun
Giorgio Pellegrini

96 Air Conditioning the Colleges
Morris V. Gelders and Louis S. Booth

106 Ramelli's Diverse and Artificial Machines
James Kip Finch

112 Engineering Ethics . . . The Search For A Single Code
Hunter Hughes

124 On the Scene at Stockholm
Donald Quick

128 Compare the Costs of Alternate Designs
Herbert F. Shatzman

BRIEFS

80 Wisconsin's Institute for Consultants to Become Annual Event

136 NSPE At Boston

148 Congressman Scherer Supports Highway Design by Consultants

154 Nation's Water System Inadequate

DEPARTMENTS

Cover: Personality — Alfred H. Samborn

8 Pride and Prejudice
26 Readers' Comment
34 Readers' Guide
39 The Word from Washington
51 Heard Around Headquarters
58 "Quote . . . End Quote"
70 From the Editor's Tranquil Tower
75 The Legal Aspect
84 Presenting Our Authors
162 Books
185 Field Notes
190 Men in Engineering
195 Reporting the New Projects
200 Scraps & Shavings
206 Consulting Engineers' Calendar
208 Advertisers' Index

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BPA

How Imaginative Engineering Provided Air Conditioning To Fit A School Budget

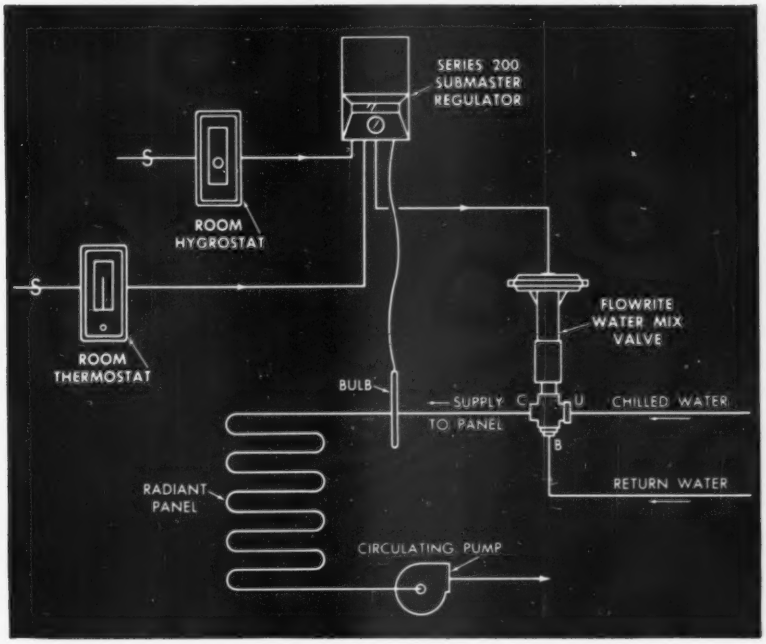
Must school air conditioning always be "too expensive"? Perkins & Will, Chicago architects and engineers, didn't think so last year when they designed suburban Homewood-Flossmoor High School. Without exceeding the school budget, they provided an air conditioned area large enough for complete summer sessions, including 15 classrooms, the library and all administrative offices. Actually, cooling for 25,000 square feet added less than 3½% to normal building cost — less than $4 per square foot of cooled area.

Homewood-Flossmoor High School, Flossmoor, Illinois. Air conditioned section (center) connects to other school facilities by glass-enclosed passageways.
Architects and Engineers: PERKINS & WILL, CHICAGO
Mechanical Contractor: THE ECONOMY PLUMBING AND HEATING CO. OF CHICAGO.

Perkins & Will team of architects and engineers works out details of the cooling system design features and controls for the Homewood-Flossmoor school. From left to right are F. Philip Brotherton, Designer and Project Architect; Rudolph J. Houkal, Chief Mechanical Engineer, and Edward C. Colin, Chief Structural Engineer.

How it was done

Perkins & Will grouped all rooms where both heating and cooling were desired into one section of the school. An interesting design feature is the core of 15 classrooms, surrounded on all sides by other rooms. The fuel savings realized from this "insulated" core help defray the added expense of cooling the entire summer school section. The engineers concentrated all mechanical service equipment beneath this section to eliminate long air conditioning channels. Double ducts and automatic controls were carefully designed for easy switchover to cooling and to take full advantage of tempered return air and outside air during spring and fall seasons.



Ceiling Panel Condensation Control

To back up the mechanical efficiency it so carefully designed into the heating, cooling and ventilating system, the Perkins & Will firm specified a Powers system of pneumatic temperature control, including the important dew point control which acts on the chilled water auxiliary cooling used in rooms exposed to the outside. This control (see diagram) utilizes a Powers Water Mix Valve on the ceiling panel chilled water supply and a low limit Submaster Regulator. The Powers Hygrostat measures room humidity conditions and resets the low limit temperature to prevent condensation on panel surfaces, yet allows supply water temperature to be as low as possible for maximum cooling.

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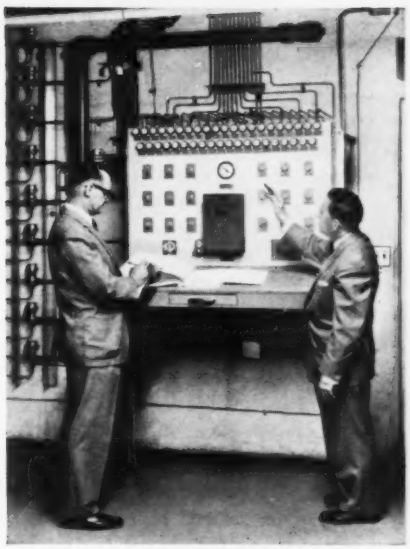

Homewood-Flossmoor Maintenance Superintendent William C. Drews (left), takes readings from the automatic Powers pneumatic control panel.

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How many consulting engineers demand the same independence, the same freedom from commercial prejudice, in the editorial pages of their business and professional magazines? Many of our readers are conscious of CONSULTING ENGINEER magazine's editorial policy in this respect: The articles that the editors select are written usually by consulting engineers, sometimes by the editors themselves, occasionally by professors or other independent experts – but never by manufacturers or those connected with the sales of products specified by consulting engineers.

In a little booklet called *Notes for Authors* (write us for a copy), the editors put it this way:

"We accept articles on engineering subjects only from consulting engineers (engineers in private practice) or other independent experts. The reason for this is that our readers are engineers who offer their clients advice that is unbiased by any sales or manufacturing interest. We feel that CONSULTING ENGINEER, as the consulting engineers' professional magazine, owes its readers this same independent point of view. It is for this reason that we must reject technical or engineering manuscripts from manufacturers or their public relations people."

The next time you look through a trade or business magazine, make a quick check of authors of the articles. Many of these authors are manufacturers or salesmen with a particular product or type of product to push – the vice president of Ace Gismo Company writing on "How to Specify Gismos." How many of these men would you introduce to a client as an independent expert whose opinions were in no way colored by commercial interest?

As a matter of fact, manufacturers do have a lot of good information – product information – in which the consulting engineer is vitally interested, and our readers show consistent and intense interest in our advertising pages and the products advertised. That is as it should be – as it must be if we are to stay in business. But the editorial pages are a diffierent matter. They purport to give information and advice uncolored by commercial connection –and in CONSULTING ENGINEER magazine, they do!

This policy of editorial independence of commercial influence is good both for the readers and for the advertisers. The readers can be sure that the articles they read in CONSULTING ENGINEER are pushing no particular product; they are in every way unprejudiced. The advertisers can be sure that the editors have selected articles according to their judgment of reader interest without having to balance advertiser against advertiser and product against product. Everyone gains.

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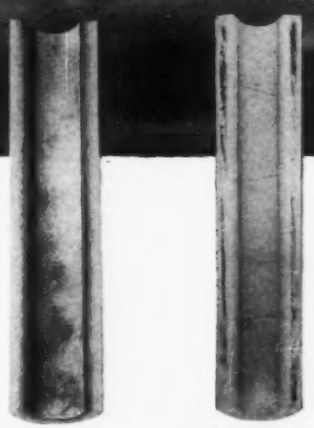

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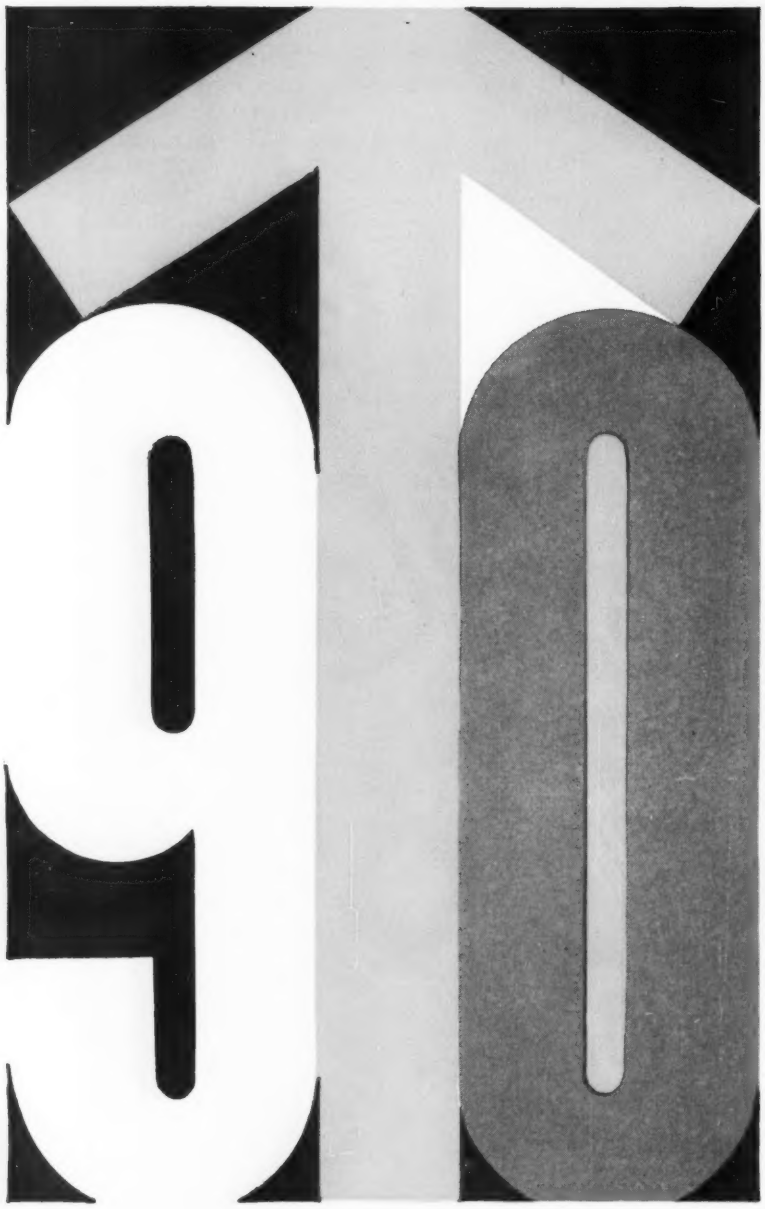

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Disneyland's Sound Engineer*

engineering," at least of one type. "Only recently, we received a letter from a New England manu-

Alfred H. Samborn

– Starts on front cover

Samborn and his engineer partners, Jack N. Steketee and Fred C. Limbert, wanted to remain engineers and not be forced to spend most of their time concentrating on business problems as their 12-year-old firm grew to its present 73 employee size. The architect partners in the firm, Erwin J. Otis, Jr. and John H. V. Evans, had the same attitude.

"We realized that someone had to devote full time to running the business. We were spending so much of our own time being engineers and architects that the clients were not being billed promptly, office purchases were not being checked, and the business was generally running itself."

So in 1955, Nathan J. Schwartz, a certified public accountant, was asked to join the firm as an associate. Since then, the office has run efficiently, and the professional engineers and architects in the organization have been able to devote their time to what they do best – design.

Samborn also has another unusual policy in his office. The firm is a miniature United Nations with engineers and architects of many nationalities. Two employees – a Hungarian architect and a Bulgarian electrical engineer – were hired, on the recommendation of the Council for Emigres in the Professions, in New York City. Schwartz, although he is one of the busiest men in the firm, managed to devote considerable time and effort to arranging for the Hungarian's family to be brought to the United States.

Recently, a Chinese, who had come to the United States on a student visa, had his visa extended to work for Samborn. However, he since has returned to his family in Red China.

This policy of hiring immigrants, some of whom speak very little English, has worked well for Samborn. "There are disadvantages. Language is somewhat of a barrier, especially technical terms, but we have obtained some very creative people from other countries."

Samborn has been very active in the three levels of NSPE for most of his professional life. He is concerned about registration in his firm. And as a result, about half of the staff is registered. He attained this not through pressure but through giving special privileges to the registered men. When a man passes the registration examination, he immediately is given a raise. His certificate also is framed and placed in the reception area alongside the certificates of the partners. Samborn also has set an example. He is registered in three states and has a certification from the National Bureau of Engineering Registration.

Each registered man is given personal credit for his design work. The firm buys a stamp for each registered man, and this stamp is kept under lock and key available only to the owner. A man stamps his own drawings. "This gives him a sense of personal accomplishment. And since many sets of drawings contain seven or more registration stamps, the client sees that his work has received considerable professional attention."

The partners, of course, still take personal responsibility for each project. The seal of the supervising partner is placed on the cover of the plans and specifications, giving him over-all responsibility for the contents.

All registered employees are encouraged to attend technical and professional meetings, seminars, and conventions with all expenses paid by the company. If the employee holds office in an engineering or architectural organization, he also is provided any clerical and stenographic help needed for preparing reports and other work of this nature. Samborn, himself, is a member of ASCE. The firm also pays part of the cost of any special technical schooling an employee wishes to take if the principals believe it of value to the firm.

Samborn, Steketee has a training program for its young engineers. For the first 10 years, the engineers are encouraged to diversify, and thus gain a broad knowledge that will prepare them to function as job coordinators in the future. After that, they are allowed to choose a specialty, such as concrete design, steel design, air conditioning design, or power distribution. "Being only 12 years old, the firm does not know how this program will work. But we will be finding out in a few years," Samborn added.

This July 1st is a date of change both for Samborn and for his firm. When Samborn first went into practice in 1948, as A. H. Samborn & Associates, he moved into a small office in the Toledo Terminal Building. Since then, he gradually has enlarged the quarters in the same location. On July 1st the firm moves into the new glass skyscraper of Libbey-Owens-Ford in downtown Toledo. Also on July 1st, Samborn's term as chairman of the Functional Section ends. But he plans to continue as an active member. "I will not neglect the problems facing the profession, one of them being the elimination of 'free engineering.' This is one of the areas in which I would like to see the Functional Section make continued progress."

Since Samborn's firm does quite a bit of materials handling work, he is very conscious of the "free engineering" problem. "I have remodeled projects on which the initial design was handled by manufacturers doing 'free engineering.' Often my clients learned just how expensive 'free' work can be."

Samborn said the Functional Section has made considerable progress in the battle against "free

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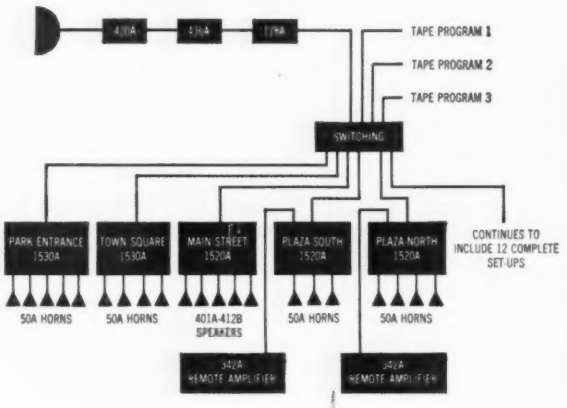

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*Sound Engineer for Disneyland is the Ralke Co., Inc., Los Angeles

See our catalog in Sweet's Architectural File 34/AL; Industrial Construction File 17e/AL, 1960 Edition

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engineering," at least of one type. "Only recently, we received a letter from a New England manufacturer agreeing to stop offering engineering along with his product. The Functional Section had asked the local state society to write to the manufacturing company president calling the official NSPE policy on 'free engineering' to his attention and pointing out the pitfalls, both to the manufacturer and to the public, of such a practice."

Progress in Several Areas

In a review of NSPE Functional Section activities for the year, Samborn said he thinks progress has been made in a number of areas.

"Of course, the most important accomplishment of the year was the completion and distribution of the survey on consultants' engineering costs on Federal projects. My successor, L. M. Van Doren, of Topeka, devoted a tremendous amount of time to this project, and we are all proud of the results."

The survey, with cost figures provided voluntarily by 118 consulting engineer firms covering 1464 engineering projects with 17 different Federal agencies and bureaus, is a prime example of cooperation within the consulting group, Samborn said.

"The primary advantage of an organization such as NSPE is that engineers in all fields can settle their problems within the group. For example, during the progress of the survey project, government engineers and consultants met frequently within a period of about two months, and as a result NSPE adopted a policy statement regarding the use of consulting engineers by governmental agencies. This policy will carry more weight with the public than it would have coming only from a group of consulting engineers. The broad NSPE endorsement means it is not merely a report from a self-interested group trying to get business."

Samborn thinks communication within the profession is one of the primary problems of the engineer. And he pointed to two programs aimed at improving the situation.

"We began the *Private Practice News* this year, and I think it has been very successful. It keeps the consulting engineer informed of legislation and other developments which could affect him. We purposely have given little space to chapter and state activities, feeling attention should be concentrated on nationwide problems."

The committee on liability insurance currently is involved in keeping the membership informed on potential problems in this area. "One problem is this – the more engineers who take out insurance, the more widely known the policies become. This could result in an increased number of claims. And as this happens, more engineers are almost forced to have the coverage. I do not know the answer

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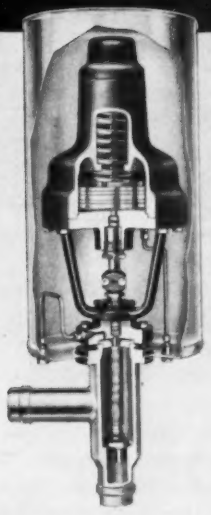

This spotless room is used only to assemble ultra-clean control equipment for the nuclear power field and guided missile program. It is pressurized and conditioned by filtered air. Nothing in the "White Room" is touched with bare hands. Daily cleaning is accomplished through vacuum outlets in the walls.

Technicians use special pre-cleaned tools to assemble the equipment. They are outfitted in lint-free garments and plastic boots. These precautions insure that each piece is immaculate until capped and sealed for shipment.

SS24RA–a typical example of the severe standards required in the nuclear power industry. Fisher engineers specially designed this control valve to handle "hot" radioactive material within the body as well as surrounding areas. The alloy body was hermetically sealed by inert gas seal welds. When subjected to a mass-spectrometer leak detector test, a leakage of less than 1×10^{-6} cc per second, at standard conditions was shown.

Finally, the entire control valve is completely encased to permit decontamination of the system. Constructed in 1" to 12" sizes.

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to the dilemma. But at least we are keeping our membership informed of any claims or lawsuits against engineers so they can take proper precautions against becoming involved in similar actions."

Samborn was active on the committee five years ago that decided that the Consulting Engineers of Ohio (the state functional group) would remain within the framework of the Ohio Society of Professional Engineers and not join the Consulting Engineers Council. Samborn thoroughly approves the decision.

"In NSPE we are professional engineers first and businessmen second. I think CEC spends too much time on problems which are the private business of the individual consulting firms. These matters cannot be solved on an over-all national basis. It seems to me that perhaps CEC is going too far toward becoming a self-interest trade association.

"I do not think consulting engineers need a trade association. I know what my business costs are, what my fees should be, and have my own ideas as to how to conduct my business. Any problems in this area would best be handled through an organization for men such as Nate Schwartz, our CPA."

Samborn also thinks the parallel courses of the Functional Section and CEC create problems. "For instance, we recently sent out a letter asking consulting engineers to carry their own weight in NSPE by making contributions to the Functional Section. One of the programs on which the Section was working at the time was the survey on engineering costs on Federal projects. A short time later, many of the same consultants received a letter from the Consulting Engineers Council also asking for contributions to a fund to fight Federal legislative attacks against the consulting profession. It seems unfair to ask consultants to contribute twice for the same thing."

Thoughts on Merger

Does Samborn think a merger of the two groups would be a solution?

"Yes, it would be a solution to this double financial problem and perhaps others, but I don't believe we are ready for a merger at this time. Personally, I would like to see conflicting areas of interest better defined before we talk of a merger.

"In the meantime, with the work of the Functional Section covering many broad areas, we will continue to offer our cooperation to other groups working toward solutions of the same problems. For instance, copies of our cost survey were sent to CEC, the Engineering Division of the American Road Builders' Association, and the Founder Societies interested in the problem."

While holding national office, Samborn has continued to take an active part in state and local So-

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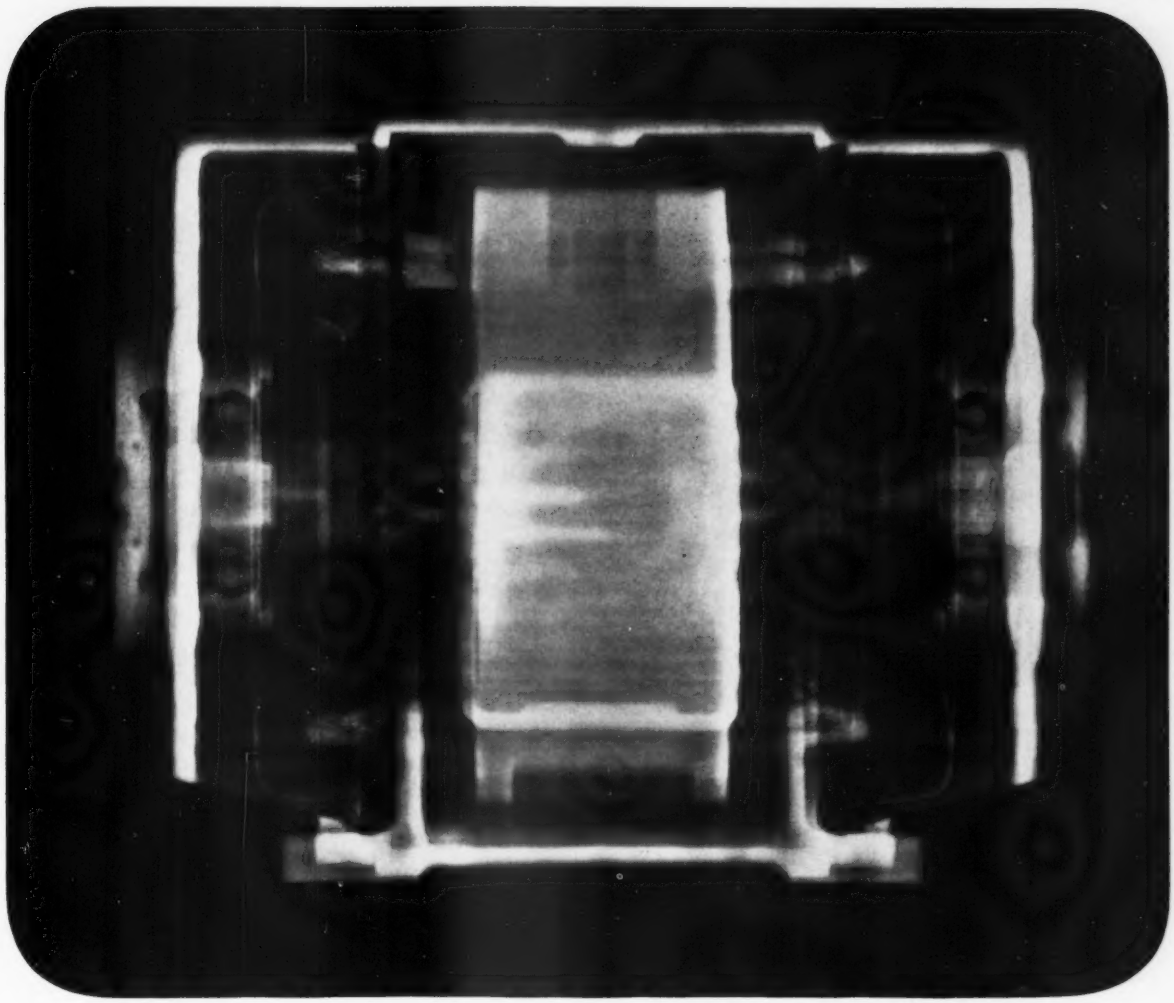

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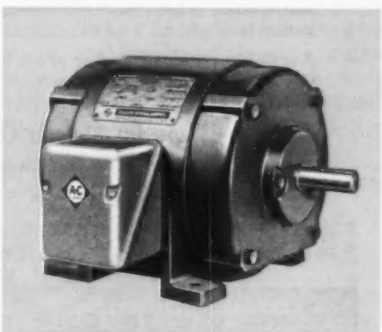

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ciety activities. "In an organization such as NSPE, it is important to stay active on a local level."

The Ohio Society, the largest in the nation until New York recently increased its membership, had eight Functional Sections for a number of years before the National Society advocated such groups.

The Consulting Engineers of Ohio also has a subcommittee of principals in consulting firms. Dues to this group are paid according to the number of employees, and funds collected are used to "promote the prestige of consulting engineering services through unified high level publicity; to aid in sponsoring or opposing legislation affecting public welfare and consulting engineering; to develop interprofessional principles of practice along recognized channels for the benefit of the consulting engineer and the general public; to promote high standards of performance and professional integrity among its members; to refer cases of unauthorized or unethical practices to OSPE; and to act in any manner necessary for the protection of the public." The basic tenet of the Functional Group within the professional society is to provide a forum where the individual engineers can meet for discussion and united action. All action of the Principals Group is subject to CEO and OSPE approval, and its membership includes about 120 firms.

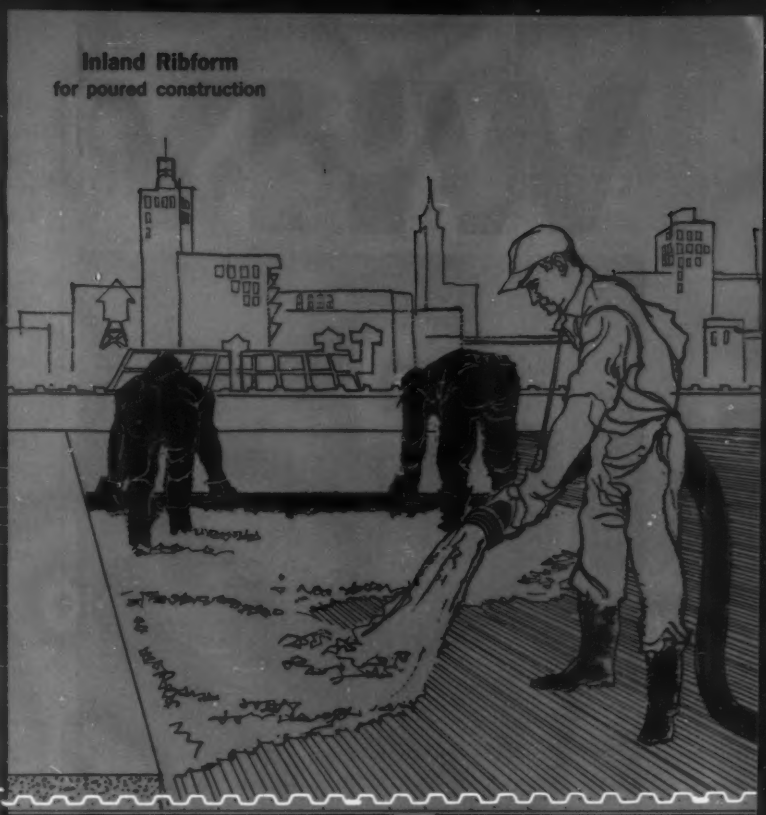
OSPE has a joint committee with architects, where such problems as policy statements as to definition of what projects would constitute architectural or engineering jurisdiction are ironed out. This committee also aided materially in eliminating architectural-engineer registration by influencing colleges in Ohio Universities to discontinue offering such degrees.

As a result of a recent problem between architects and attorneys in Ohio, the CEO has requested consideration of OSPE for the formation of a joint committee of engineers and attorneys. The lawyers and architects recently had a disagreement over general and special conditions in specifications and over contracts. Should these be written by architects or attorneys? The question currently has been tabled, but there is the possibility of a similar question arising in the future on engineering specifications and contracts. CEO wants to be prepared.

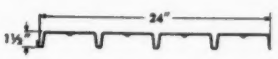
Professional Background

Samborn, a native of Toledo, opened his consulting practice in his home town because "I could and still can see a great growth potential here."

The son of a blacksmith, Samborn gained an early interest in engineering from his father. "Although he was a blacksmith, he took tremendous pride in his craftsmanship and was a designer of sorts. He encouraged my interest in engineering." After graduating as a structural engineer from the



Steel deck or centering...you name it, INLAND has it!



A-DECK — For purlin spacings not exceeding 8'4". Narrow ribs provide deck surface that supports the thinnest or softest types of insulation.

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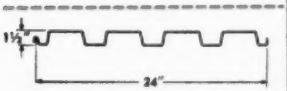
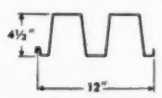
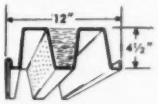


B-DECK — For spans to 10'0". Wide rib distributes metal for greater structural efficiency. Well suited for use as side wall panels.

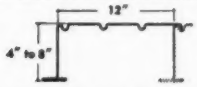
B-ACOUSTIDECK — Two-in-one panel combines steel roof deck with acoustical ceiling having Noise-Reduction Coefficient of .70. Used for spans to 10'0".



C-DECK—Carries normal roof loads over spans up to 24'0". Used extensively in canopies.



C-ACOUSTIDECK — Offers same Noise-Reduction Coefficient as B-Acoustideck. Can be used for spans to 24'0".



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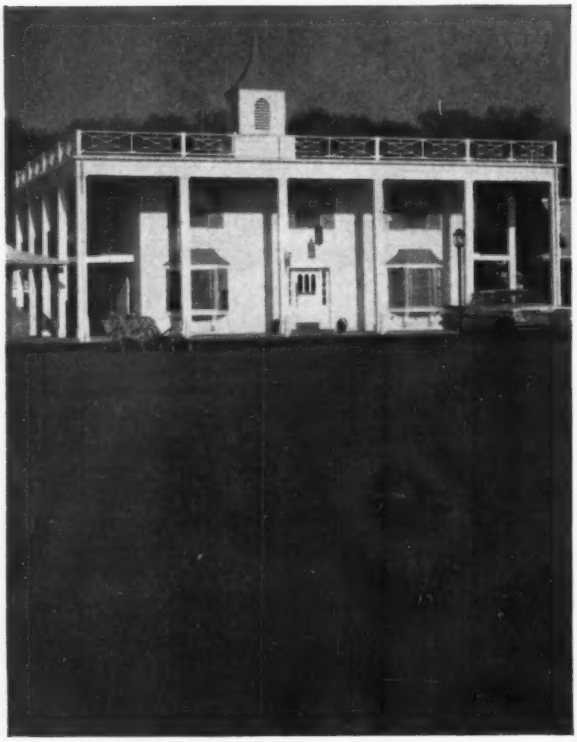

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University of Toledo, Samborn enrolled at Case Institute of Technology to take graduate work. "Jobs were not easy to find in 1939, and after being in Cleveland for several months I finally went to work for a firm manufacturing antennas for car radios. I did some drafting, and ran errands." A short time later, he went to work for Builders Structural Steel Co. Although hired to run the blueprinting machine, he soon was doing detailing and design. "The chief draftsman found out I was the only graduate engineer in the drafting room.

Samborn's next job was with Giffels & Vallet, in Detroit. "I remember my first day at work. The personnel director who had hired me was not at the office when I arrived, and one of the partners sent me to the ink tracing department. I was ready to quit by the time the personnel director came to see me." However, Samborn immediately was assigned to the structural detailing department, and six months later to the industrial engineering department. "That is where I became familiar with materials handling. Today, under the direction of my partner Fred Limbert, our firm has an industrial engineering division patterned in many ways after that at Giffels & Vallet."

Samborn met Steketee, his first partner, at the Detroit consulting firm. "It is unusual to have partners with almost identical backgrounds build a consulting organization, but it has worked out well."

When war was declared, Samborn tried many times to enlist in the Seabees. "Their medical standards were too high for my flat feet." However, in 1943 he managed to enlist in the Navy. After graduating from Midshipman's School, he was commissioned in the Civil Engineer Corps and assigned to the Seabees after all. The next three years he was in the South Pacific as personnel officer and assistant company officer of a construction battalion. His group specialized in the design and construction of water supply systems, and they hit all of the better islands, including Saipan and Okinawa.

"After V-J Day, I was kept on duty at Okinawa for some time. In the Navy, dependents counted quite a bit on the point system for separation, and I was single." When he finally was sent home, he was given a 45-day leave, but still no separation.

"During those 45 days, I did not have much to do. That was the time I looked around Toledo and decided to open a consulting practice here as soon as I could afford it."

Returning to Giffels & Vallet after his separation from Navy duty, Samborn was made a designer and later a project coordinator. Wanting to learn about the organization of small consulting firms, he then went to work for a small organization in Detroit. ("It was really small. I was the only registered engineer in the place, including the part-

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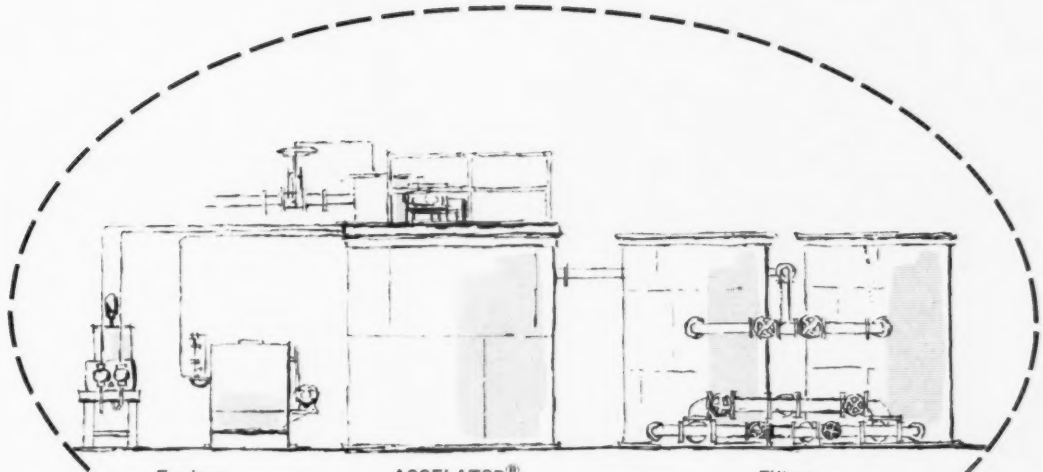

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ners.") Six months later, he decided it was time to start his own practice. Again, his experience at Giffels & Vallet paid off. An engineer he once worked with in the consulting firm then was chief engineer of Spurgeon Conveyor Company, and he gave Samborn his first project – the design of a coal handling system for the Kaiser-Frazer Corporation, at Willow Run, Michigan. The firm was converting from oil-fired to coal-fired units in their boiler house.

Typical Projects

One of Samborn, Steketee's largest projects was the recent design of a complete electrode graphitizing facility at Monterrey, Mexico, for Electrodos Nacionales, a division of Union Carbide International Corporation. The first complex included design of all processes and manufacturing facilities plus adjunct requirements of site work, office building, cafeteria, and power supply. The program was planned to provide orderly expansion which is currently under consideration.

Samborn's current organization is quite diversified, including two firms. Samborn, Steketee and Associates, Otis & Evans specializes in integrated engineering-architectural projects – industrial, institutional, and commercial. This group annually handles projects valued at $40 million. The other firm, Hatch, Samborn, Steketee & Associates, does highway design with average annual projects valued at $4 million.

The engineering-architectural firm has become well known in Ohio for its design of housing projects for the elderly. Recently it designed the first unit of Crestview, a village for the elderly sponsored by Flower Hospital of Toledo. The development includes modern apartment buildings, central dining facilities, recreational areas, and a 300-bed hospital. The building is the first in the nation using two-way voided lift slab construction.

Designed for the middle and upper income brackets, Crestview Apartments are rented on a cooperative basis. Residents pay a "founder's fee" of $5000 or more, depending on the type of accommodations. Then an additional $150 monthly fee provides three meals a day, apartment maintenance, and any necessary medical or hospital expense.

The combination of complete architectural and engineering design services is essential to modern consulting firms, Samborn thinks. "We are able to give the client a complete, well coordinated design."

But no construction! As Samborn's brochure points out. "No construction contracts are sought, no equipment is offered for sale. Only in this way can you be assured of unbiased engineering-architectural service in the selection of materials and equipment." ▲▲

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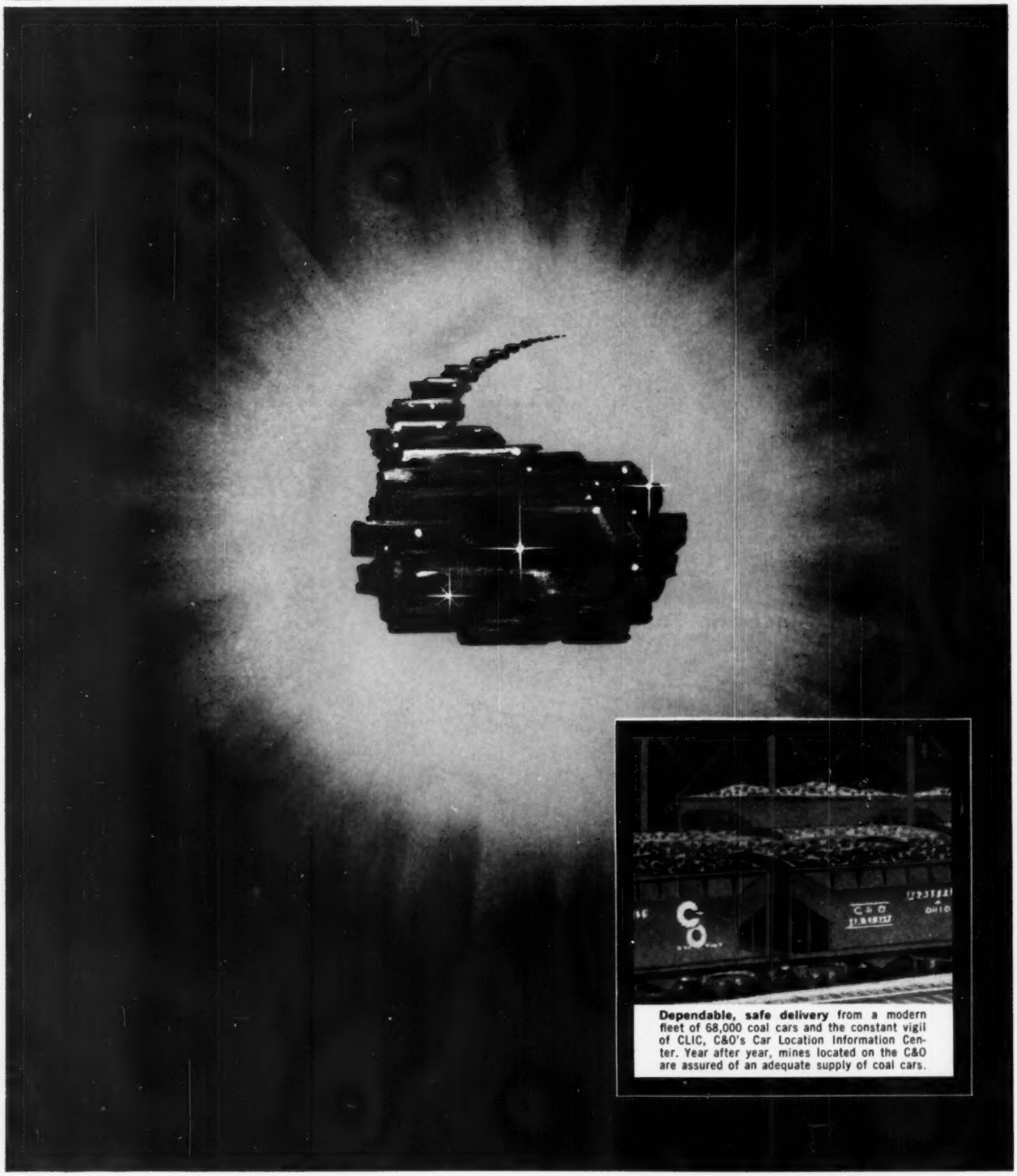

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Readers' Comment

Many Codes Ago

Your article on "A History of Engineering Ethics," [published in this issue, page 112] has been read with keen interest. When I was retired from the University some years ago, I had to give up my office there, and in doing so, I had to throw away several tons of booklets, reports, and correspondence that had accumulated over the previous 40 years. The extensive files on codes of ethics went into this discard. Hence I have had to depend on memory.

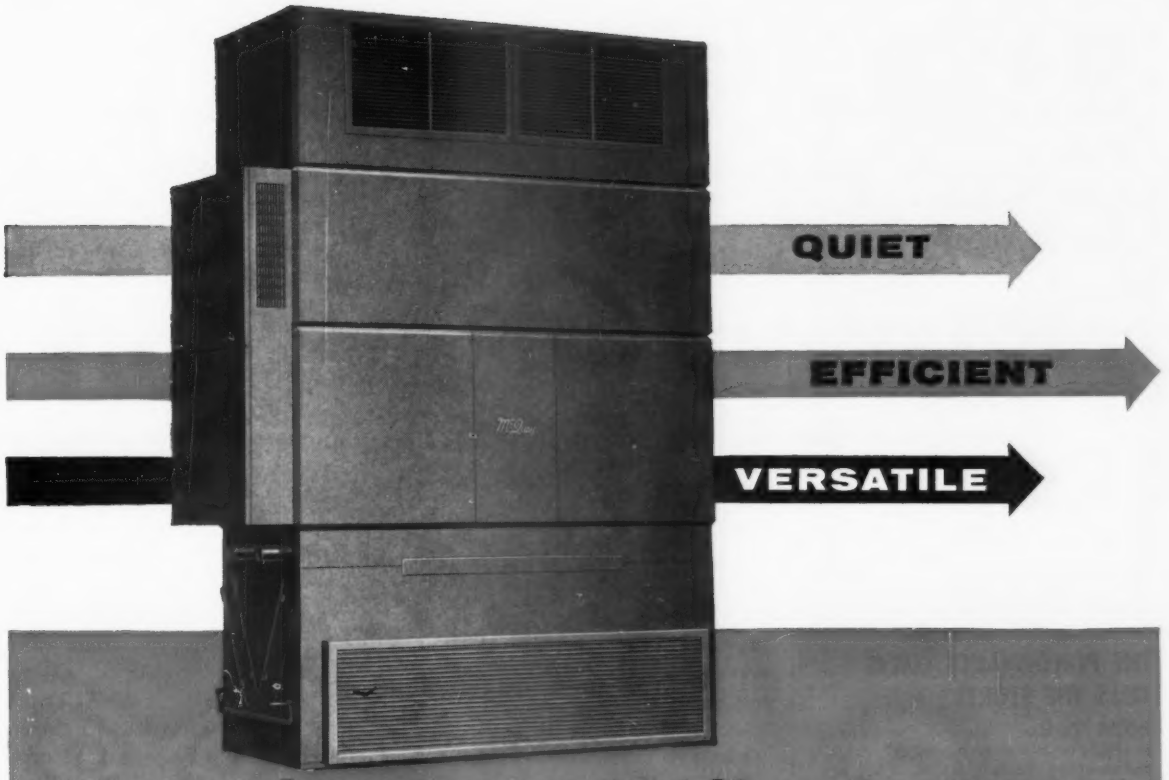
Some facts were recalled by your article. Referring to the joint code of our Joint Committee that was adopted in 1922, my recollection is that the Engineering Institute of Canada was asked to participate in this Joint Committee as engineering practices are quite similar in the two countries. I do not recall the reasons why the Institute was not formally represented on the Joint Committee. But when the Joint Code was announced, the Engineering Institute of Canada was one of the first organizations to adopt it. I believe that this was the beginning of the close association of the Canadian Institute with later attempts at joint professional actions.

When the code of 1922 was being drafted, there was, as you have indicated, a desire on the part of engineers for a short, simple and easily remembered code. Clause after clause was submitted and modified. Finally Dr. John C. French, then Professor of English at Johns Hopkins University, was asked to aid me in a final draft of the clauses. Dr. French very skillfully consolidated and reworded the clauses until it was boiled down to the final form. The code was well received. Universities over the country issued it to their graduating engineers. It was reprinted by many concerns and widely distributed. The code had been written in a positive language and one could remember its specific admonitions. I have personal doubts whether many engineers can recall sections of the present Canons or have even read them.

Our Joint Committee realized that interpretations of the code would be necessary and we recommended that each society have a "Standing Committee on Professional Conduct," and that these committees interchange interpretations. After ASME accepted the code, its representatives on the Joint Committee were made a Standing Committee on Professional Conduct of that Society. I served as chairman of this committee for five years during which many inquiries were referred to the committee. My recollection is that several members were dismissed from the Society on the recommendation of our committee, for unprofessional conduct during that period. No extensive publicity was given to these cases, to avoid legal actions for redress.

Later, and after I had left the committee, there was one outstanding case that received wide publicity, the famous Parker Case. Parker was dismissed from ASME membership for unprofessional conduct. I do not recall the year that this took place as I was not on Council or committee at that time. Parker sued the Society and certain of its members for damages and this went to court. Parker endeavored to include me in the suit because I had been on the Power Test Code Committee that had promulgated certain rules regarding boilers that he claimed to have caused him financial losses. Parker lost his court hearing in New York but continued to harass the Society for years. Some years later when I was elected president of ASME, I was asked to clean up the Parker affair which I succeeded in doing. In view of the Parker Case, your statement that ASCE was the only society that had publically expelled a member, needs some modification.

Another factor that you should consider are the actions of the State Boards for Registration of Professional Engineers. I believe that every state law governing such registration provides for the cancellation of a license for unprofessional conduct. Boards have drafted rules which are furnished to each applicant with his application form and which outline and elaborate this clause in the law. During my 10-year term as chairman of the Maryland Board, I recall quite a number of cases upon which the board took action. One case involved a public hearing at Easton, Maryland, with legal staff on both sides, but in this case the accused was absolved of improper conduct. The case involved the interpretation of an indefinite contract and should have gone to the civil court and not to the State Board. It would be desirable for



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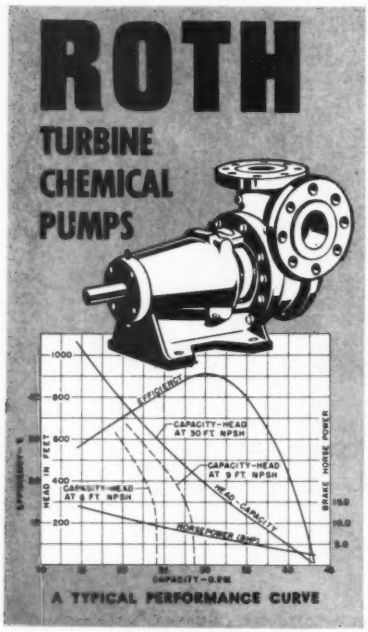

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the several state boards to have common rules and I understand that such is being attempted.

You may be interested to know that when I was in Japan in 1951 for the Army, the Japanese Society of Consulting Engineers had me spend a whole evening with them discussing consulting practices and particularly ethical conduct. Most of these men had been connected with the extensive Mitsubishi interests before the War and were confused in regard to their use of confidential data when in private practice. I again had to depend on memory as I had not known that I would be asked to discuss this subject.

You have prepared an excellent discussion of the subject. I hope that it will lead to greater interest in professional conduct of engineers, as one sometimes feels that this needs improvement.

A. G. Christie
Professor Emeritus of
Mechanical Engineering
Johns Hopkins University

• *Corrections suggested by professor Christie have been made in the article as published in this issue. His help in revision as well as in the gathering of data for the manuscript is greatly appreciated. We also gratefully acknowledge several important corrections by William Ryan, formerly of Stone & Webster, and a past president of ASME; E. L. Chandler, of ASCE; and F. J. Van Antwerpen, secretary of AIChE.*

Out of Phase

In connection with my article entitled "Analyzing Phase Connections," which appeared in the May 1960 issue of CONSULTING ENGINEER, I should like to point out that some of the vectors in Figs. 4, 5, and 6 as published do not correspond exactly with what I submitted. In the wye groups, the vectors which are not vertical or horizontal are drawn at a 45 degree angle. In a balanced 3-phase system, when one voltage vector is shown vertical, the other two are 30 degrees from the horizontal, right and left; when one voltage vector is horizontal, the other two are 60 degrees from the horizontal, up and down. They are parallel to the sides of the associated delta, which, perforce, was reproduced correctly in every case, the representation being an equilateral triangle.

I might add that this affords me the occasion to remark that this same error occurs frequently when wye groups are drawn freehand in a hasty fashion. While trouble does not necessarily follow from carelessness in drawing the vectors, it should be clear from the article that anything related to the subject of phasing analysis should be handled with appropriate care and precision.

W. A. Tripp
Chief Electrical Engineer
The J. G. White Engineering Corp.
New York, New York

Information Supplied

A year or more ago your magazine published two articles on which I would like additional information. One article concerned public relations of consulting engineers. I believe that this article was in two or three parts. The second article I am interested in was about patents and was written by a patent attorney.

If reprints of these articles are available, I would like to have one of each and I would also appreciate receiving the name and address of each of the authors of the above articles.

For some time I have been intending to write your magazine to express my appreciation of the type of material you publish for general consulting engineering consumption. The articles are, without exception, timely, informative, and exceptionally well written. I must apologize for combining a letter of appreciation with a letter of request for information, but I assure

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Ross H. Bryan
Consulting Engineer
Nashville, Tennessee

Praise Accepted

The May 1960 issue of CONSULTING ENGINEER is one of the outstanding issues in a long line of issues covering subjects which are vital to us in the profession. Congratulations!

The fact that you are now printing the articles complete in themselves, without breaking them up by "continued on page—" notices is much appreciated. Since many of the articles are found to be of reference interest, however, it would be advantageous for the reader to have the pages perforated at the binding for quick tear sheet access. Often we find it desirable to remove particular advertisements, also, for reference. Would it be possible to inaugurate the perforated page system similar to that used by *Electrical World*? It would be most helpful.

On page 62, Melvin Nord in "The Legal Aspect" referred to "General Conditions of Contract," issued by the Consulting Engineers Council and "Conditions of Contract (International) for Works of Civil Engineering Construction," issued by the International Federation of Consulting Engineers (FIDIC). Would you please advise where we might obtain copies of these conditions?

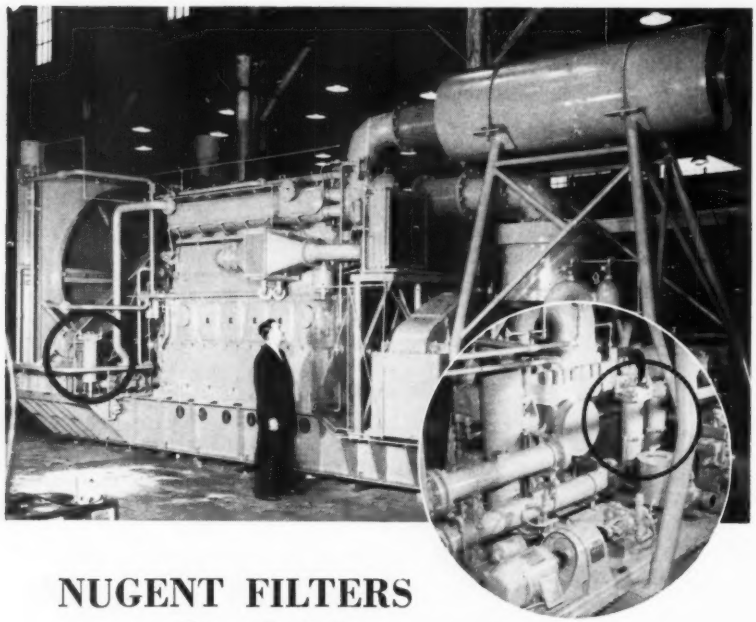
On page 102, under J. Donald Kroeker's "The Three Facets of Free Engineering," was displayed "The Consulting Engineer's Creed." Is this available in a form suitable for framing?

On page 127, McGurk's Law indicated he is well acquainted with Professor C. Northcote Parkinson (Is this McGurk's only law?), and the latter's 1st law, "Work Expands To Meet The Time Allotted", fits well into drawing preparation. I am wondering whether you will have something in the mill on drawing production scheduling and follow-up for the smaller firms which do not have the manpower-or-money-for a drawing-control group.

With the voluminous paper that crosses one's desk each day – letters, advertising literature, manufacturers' bulletins, trade magazines, et al – the tendency has to be to postpone or neglect much of the magazine reading. CONSULTING ENGINEER, however, gets read early – and digested. Keep up the good work.

John C. Endahl
Chief Electrical Engineer
Laramore, Douglass & Popham
Chicago, Illinois

• *Reader Endahl's requests have been answered by letter. However, our readers should note that tear sheets of articles are almost always available on request. No need to tear up an issue for one article!* ▲▲



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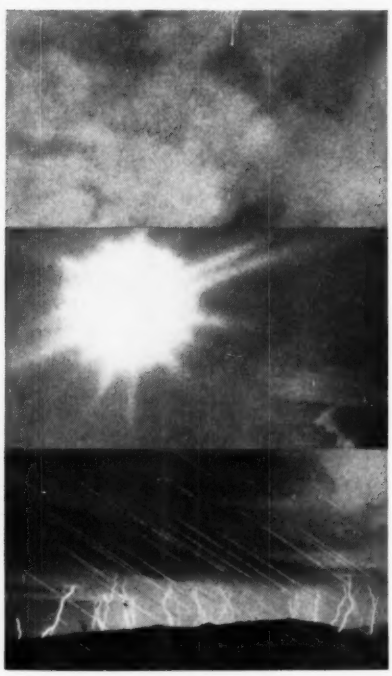

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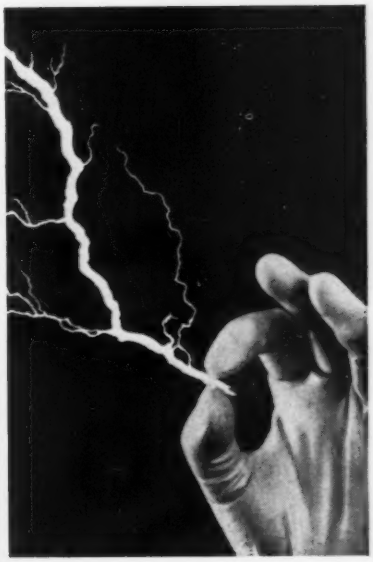

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The Readers' Guide

Air Conditioning for the Colleges

(page 96)

If consulting engineers have their way, one of our fondest recollections of college will never be for the modern student. Sometime in May, or April if lucky, a breeze came through the classroom windows, a wind so warm that it had no business being about so early in the spring. This wafted warmth we called "The Voice of the Turtle," and when it came suddenly upon us for the first time that season, it turned us firmly from thermodynamics and strength of materials to the real world of spring sounds, iced drinks, and week-end dates. We can only regret that the students at Clemson will have to find some new call to Converse and the girls at Converse will have to await some different sign of the season, for Lockwood Greene has air conditioned both institutions. Mr. Gelders and Mr. Booth, oblivious of the need for a spring mating call have closed the college windows and made it possible for the students to keep their minds on texts and lectures for a cool extra month or so. It had to come. As engineers and as parents we can approve. May our memories forgive them.

A History of Canons and Codes

(page 112)

It was in the decade before World War I that each of the several engineering societies began intensive efforts to codify the ethics of its segment of the profession. The result was a mess of similar but slightly differing codes that confused the engineer and led more to apathy than probity. A generation later, in the mid-thirties, the attack was renewed, this time as a joint effort under sponsorship of the Engineers Council for Professional Development. They came up with the Canons of Ethics for Engineers, a publication often discussed but seldom read. The history of ethics published in this issue will help fill in the background from which the Canons and the Codes came and let the reader understand them better when next he finds time to study them. Professional ethics, it must be kept in mind, do not come naturally. These are not rules one learns at mother's knee unless mother happened to be an engineer.

Client and Contractor Pay Consulting Fees?

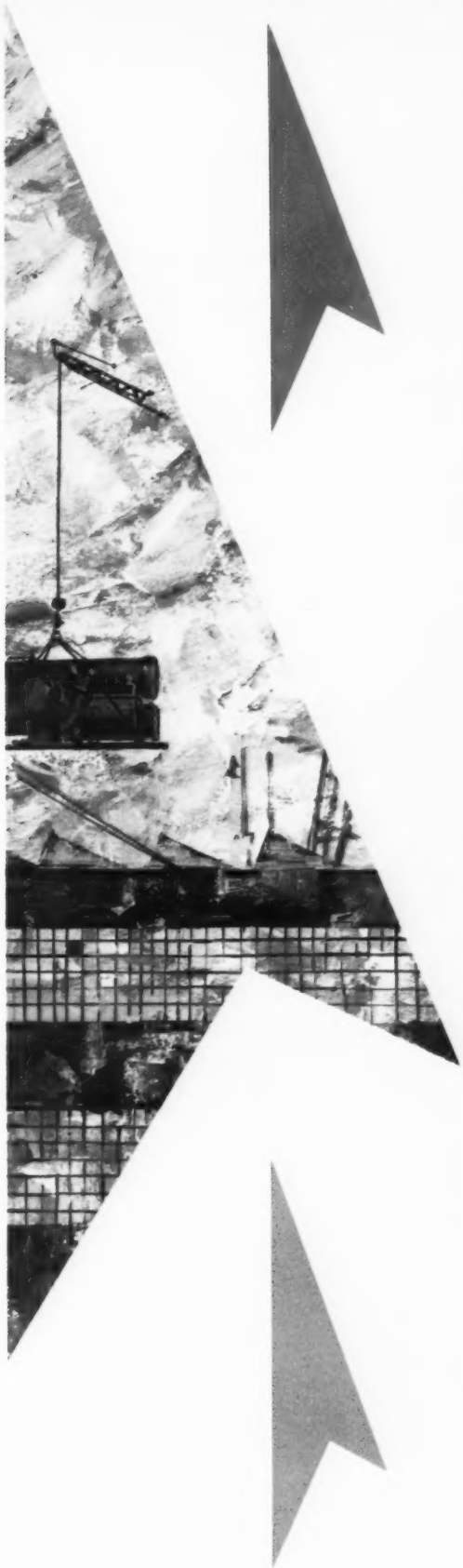
(page 86)

Warner Howe, a well known and much respected Memphis practitioner takes the position that consulting engineers should provide much more in the way of detail shop drawings and thorough supervision than is now generally offered. This is a premise he has little difficulty establishing. Then he comes to the question of the fee, and he argues that the additional compensation for these services should be a part of the construction contract, the engineer being paid by the contractor. This is, he says, an established practice in Memphis, just as it is accepted in Chicago that the consulting engineer should be paid by the contractor for composite drawings of mechanical and electrical equipment agreed upon in the construction contract. Note that in both instances the consulting engineer is getting part of his fee from the client and then an additional payment from the contractor. This can be deemed an unethical practice, though it is condoned in the Canons if the arrangement is known to all parties. Is it indicative of a flaw in the Canons that the practice could be ethically questionable?

The Importance of Comparative Cost Estimates

(page 128)

Not enough time and thought is given to comparative cost estimates, according to Herbert Shatzman, of Seelye Stevenson Value & Knecht. He feels that the design and cost comparisons are the engineers best route to economical and feasible designs that the consultant can substantiate for the client. He has a good point, and while he does not mention it, such thorough comparisons can help the consulting engineer avoid client demands for competitive designs, a costly practice common in some parts of Europe. If the consulting engineer prepares his own comparisons of both cost and design, he need not fear that the intelligent client will feel the need to test them competitively.



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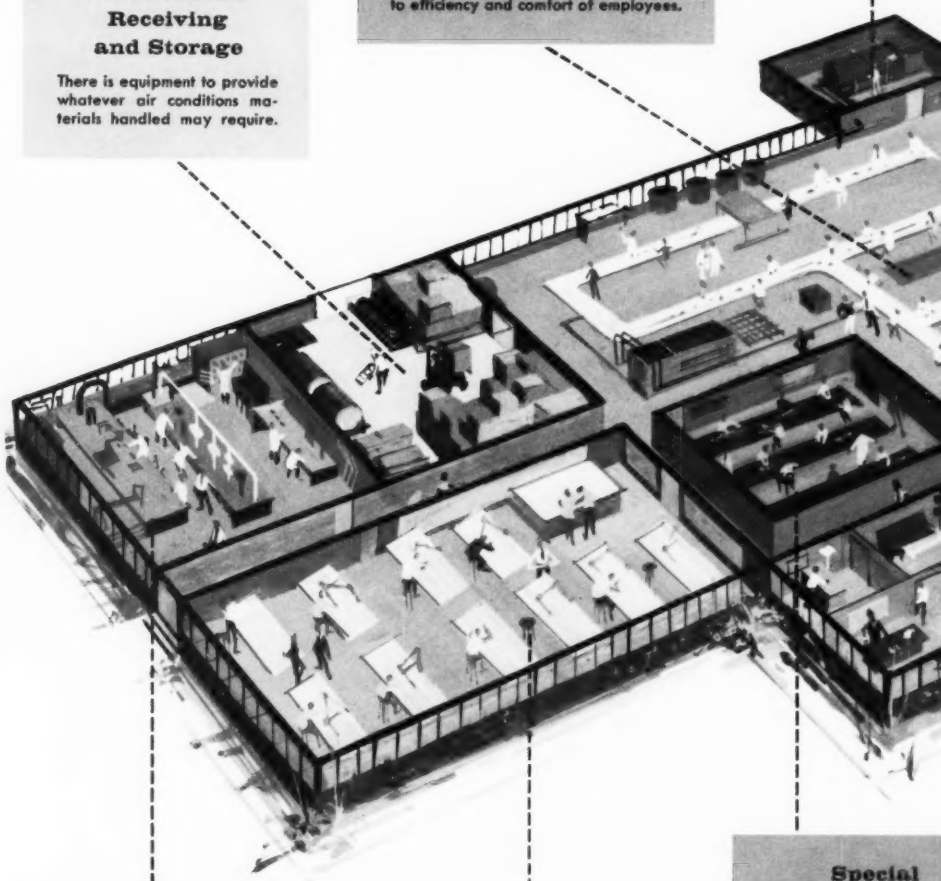

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Finishing Room

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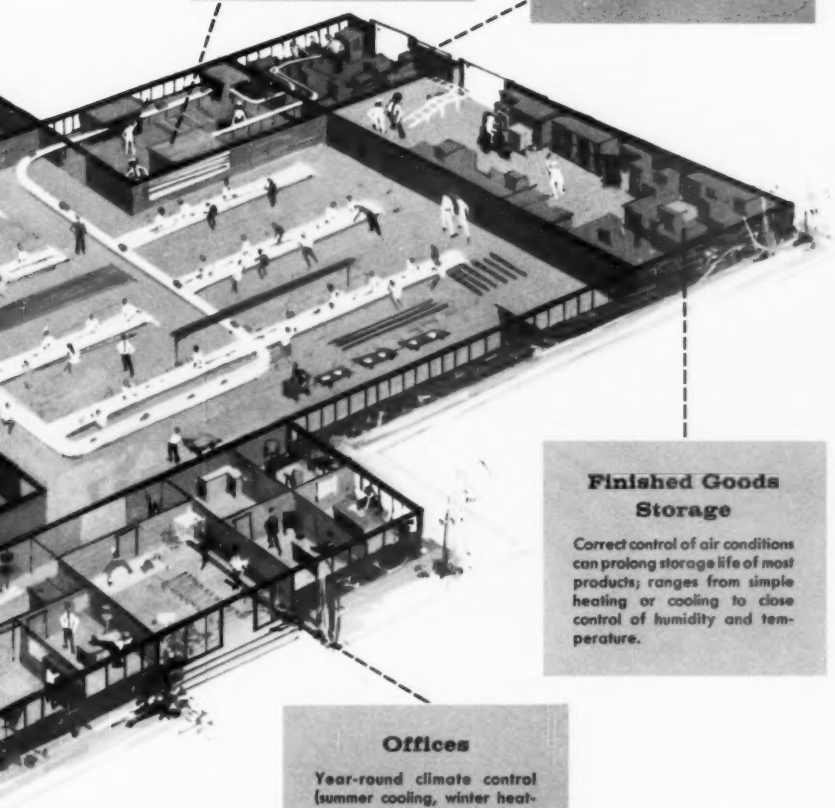

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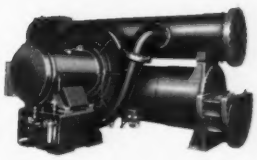
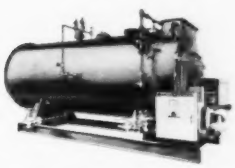
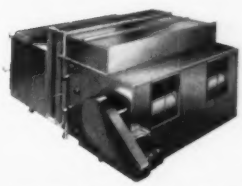


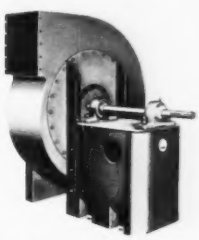
Centrifugal refrigerating machines for central-station systems.



Firebox, scotch-type steel boilers, package units for heat, steam.



Central-Station air-conditioning units for cooling and heating.



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The Word From Washington

EDGAR A. POE, Consulting Engineer Correspondent

A CONGRESSIONAL policy against the requirement by Federal departments and agencies of bidding for professional engineering services may have been set for a considerable time to come in the closing days of the 86th Congress. The House Armed Services Committee removed such a proposal from the Armed Forces Procurement Act which Chairman Carl Vinson (D-Ga.) had introduced.

A Committee spokesman said that the Committee agreed that the fees for services of a consulting engineer should not be determined by competitive procedures, but by negotiation. Apparently the competitive provision in the original bill had been recommended by the Pentagon.

Various engineering organizations expressed vigorous opposition to the provision before it was deleted from the Vinson bill. The American Society of Civil Engineers impressed the House Committee by declaring that the public interest would be served best if agencies of the United States government contracting for professional services are encouraged to follow procedures essentially as follows:

¶ Consider the qualifications of a number of firms who appear to be capable of meeting the requirements of an undertaking.

¶ Select from the list one or more who are believed to be the best qualified, and carefully interview them separately, explaining fully the proposed service and carefully examining the qualifications of the firm, but without mentioning fee.

¶ List these firms in order of desirability, taking into account reputation, experience, financial standing, personnel available, whether the work load already being carried will permit prompt and efficient service, and any other pertinent factors.

¶ Choose the one deemed most desirable and agree on a mutually satisfactory fee, this being the first time cost is discussed.

¶ In the event that it is found impossible to agree on the fee, dismiss the firm in writing and negotiate with the one next on the list, and so on until agreement is reached.

The American Society of Civil Engineers declared that the competent practice of a profession involves creative ability. No two engineers, for example, can be expected to render identical services. An engineer who has no skill, experience, or technical knowledge can underbid an engineer who possesses the skill, experience, or technical knowledge required for the job. What usually amounts to a very small apparent saving when the contract is awarded solely on a price basis is almost certain to be lost many times over as a result of inferior conception and design, added costs of construction, operation, and maintenance.

"It is for this reason," said the ASCE spokesman, "that the code of ethics of the American Society of Civil Engineers provides that it shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the Society to participate in competitive bidding on a price basis to secure a professional engagement."

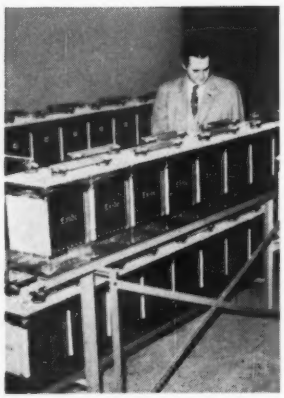
Engineer Salaries Rising

A survey by the Department of Labor showed that about 38,000 students received bachelor's degrees in engineering, the largest professional field of employment for men, during this year's graduation exercises. What is the outlook for these graduates?

With the demand for some specialties heavier than at any time in the past several years, it is very good, according to Secretary of Labor James P. Mitchell. He said the need is particularly great for engineering graduates with strong science and mathematics background to do research and development work in electronics, nuclear energy, computer technology, missile development, and other new and rapidly expanding fields of engineering and science.

The survey by the Department showed that graduates with majors in mechanical, electrical, ceramic, and metallurgical engineering appear to be the greatest in demand. Although the employ-

How to keep the lights on when power fails



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ment outlook for engineering graduates is generally favorable, employers are exercising more and more selectivity in their hiring practices.

Continued expansion of the engineering profession is expected both in the next few years and over the long run, declared Secretary Mitchell. Factors which will contribute to a growing demand for engineering personnel are the continuing needs of the $41 billion defense program (particularly in the missile field), growing population, rising living standards, expansion of industry, the increasing complexity of industrial technology, and the continued extension of research activities.

The swelling engineering enrollments expected in the 1960s in colleges and universities will require more engineering teachers. Substantial numbers of engineers will also be needed annually to replace those who retire, die, or transfer to other occupations, said the Cabinet officer.

Losses to the profession from death and retirement alone are now estimated to be more than 10,000 a year, and are expected to increase to some extent during the next decade.

The Secretary's so-called "Open Letter to the College Graduates of 1960," asserted that starting salaries offered to new graduates with bachelor's degrees are expected to be in the neighborhood of $525 a month in 1960. On the other hand, the monthly starting salaries for the small number of engineering graduates with advanced degress, particularly the doctor's degree, will, as in previous years, be higher than bachelor degree graduates.

Small Cars Cut Gas Tax Income

No one can foretell what the full impact of the small car eventually will be in the United States, but tremendous sales are assured for the next few years. Sales the past year have been greater than origi-

FLEXIBLE thinking

RIGID quality control

INTEGRATED engineering-production

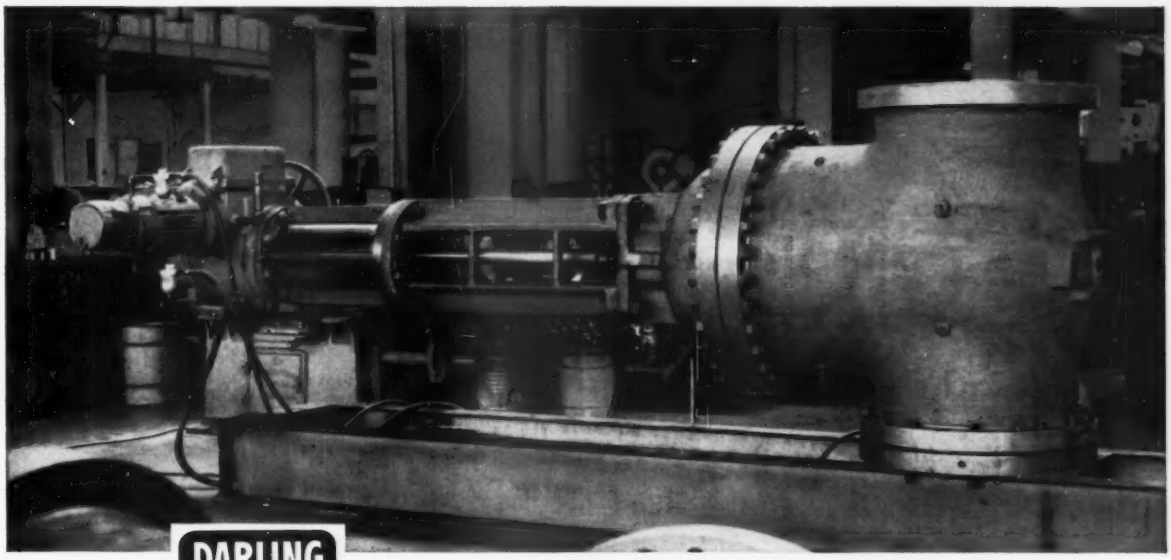
CLOSE TOLERANCE machining know-how

DARLING SPECIALIZES IN SPECIAL VALVES

For example, below is one of fifty-five Darling high temperature valves produced for a large overseas petrochemical plant. Sizes range from 3″ to 36″.

These valves operate at 1100 degrees every 15 minutes. They're designed for service 24 hours a day, 7 days a week, and for years of continuous, maintenance-free operation.

This is typical of Darling's production know-how on valves for special service requirements. Bring *your* special valve problems to Darling.



DARLING VALVES

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 5, Pa.

Manufactured in Canada by
Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

Back at the turn of the century it didn't matter much what size you were... capacity counted most. Of course the days of the big schuper and free lunch have disappeared from the American scene. However, another type of "joint"—this one tailor-made for ***all sizes*** of vitrified clay pipe, has been gaining in popularity by leaps and bounds. It's KAUL Presto-SEAL, with precision-dimensioned, factory-molded polyester spigots and sockets that ***joint like magic.*** This revolutionary development reduces shear load action to the minimum and permits a tight, equalized compression throughout the full circumference of the pipe. It's **EASY** to assemble without special tools. It's **FLEXIBLE,** regardless of temperature... will absorb all line movement. It's **PERMANENT**... leak-proof, root-proof, corrosive-resistant... provides trouble-free service forever. It's **ECONOMICAL**... less trench space is needed; no tedious joint pouring is required; extensive inspections are eliminated; saves costly labor and materials on every installation.

And—Presto-SEAL is ***not*** an experimental process of limited availability in but a few sizes of pipe. In fact, thousands of miles of Presto-SEAL, in sizes from 4" to 36", both standard and extra strength, are providing large savings in both pumping and treatment plant costs everywhere. Approvals from public works officials, engineers and contractors are evidence of the preference-acceptance of Presto-SEAL clay pipe by KAUL.

Write today for complete particulars. Then, specify Presto-SEAL pipe for your next job!

*T.M. Reg.

KAUL clay company

TORONTO, OHIO● U. S. A.

"Exclusive manufacturer of Presto-SEAL pipe that joints like magic"

nally predicted by some of the automotive manufacturers.

As a result of the success of the small cars, automotive economists declared that they are causing a revolution in gasoline consumption. Therefore, the impact may result in a major drop in Federal and state gasoline taxes.

Appearing before the Highway Transportation Congress in the nation's Capital, automotive economists agreed that the potential lower tax revenues could lead to a clamor for higher gasoline taxes. Officials of the Transportation Congress maintain that 43 cents of every dollar collected from highway users are now diverted to non-highway purposes. They called for stopping the diversion.

New Saline Conversion Plant

A $1,246,250 Office of Saline Water contract for the construction of a 1-million gallon per day sea water conversion demonstration plant at Freeport, Texas, has been awarded to the Chicago Bridge and Iron Company. The conversion plant at Freeport is the first of five saline water conversion plants authorized by Congress. The process to be utilizied in this plant, long-tube vertical multiple effect distillation, incorporates several newly developed technical innovations resulting from OSW sponsored research. The plant is expected to produce fresh water from the sea for less than $1 per thousand gallons.

Road Men Meet

Under the auspices of the American Road Builders' Association, county division, members of the Board of County Consultants to the Bureau of Public Roads will participate in a panel discussion on a "Survey of County Highway Problems" at the National Highway Conference for County Engineers and Officials at Atlanta, Georgia, September 19-21.

The Board of County Consultants, composed of one county highway engineer or official from each

THE STROMBERG-CARLSON COMMUNICATION CASE FILE
(one of a series)

A versatile sound system . . . wired for stereo yet it was custom-engineered from standard components

A Stromberg-Carlson paging and background music system is wired to provide stereophonic sound throughout the new Utica, New York, Memorial Auditorium.

Coverage is complete, with an end cluster of cellular horns plus high fidelity woofers and coaxial speakers, and a center cluster of cellular horns and coaxial speakers. The end cluster provides perfectly-placed single-source sound for stage presentations.

Other outstanding features of the system:

- 750 watts of audio power
- Versatility that permits any kind of programming and sound distribution, including broadcast material, tape and records
- Telephone intercom and paging network throughout the building
- 18 microphone circuits plus 8 additional input sources
- Three different programs can be directed to different areas simultaneously

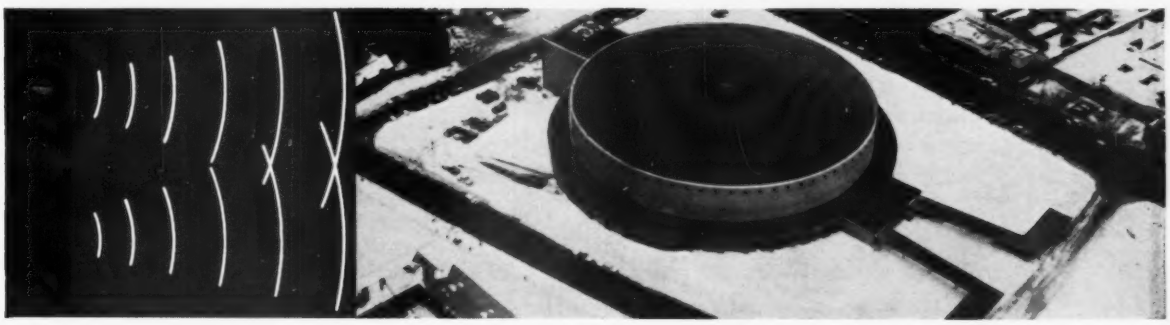
Because it is "custom-engineered" from standard components, this system assures unusual efficiency, economy, and ease of installation.

These advantages are available to meet the needs of *your* clients. Our field engineers will be glad to consult with you on any project. Our factory-trained distributing organization is ready to handle all installation and maintenance problems. You'll find their names in the Yellow Pages under "Public Address & Sound Equipment," or write to Special Products Division, 1440-07 N. Goodman Street.

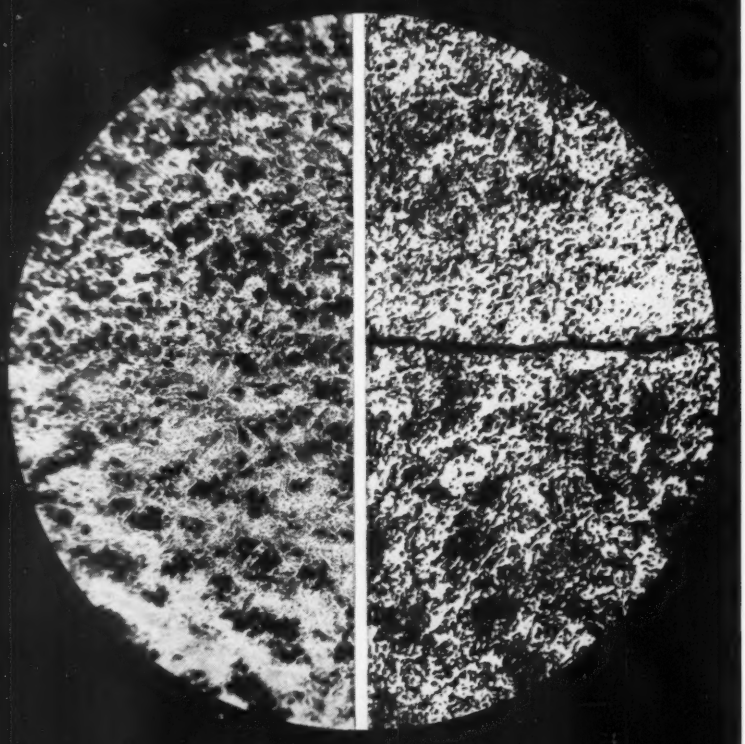
"There is nothing finer than a Stromberg-Carlson"

STROMBERG-CARLSON
A DIVISION OF **GENERAL DYNAMICS**

Stereophonic sound reproduction is a unique feature of the Stromberg-Carlson paging and sound reinforcement system in the new Utica, New York, Memorial Auditorium. Architects: Gehran & Seltzer of New York City. Associate Architect: Frank C. Delle Cese of Utica. Consulting Engineers: New York City office of Fred S. Dubin Associates. Installation by W. G. Brown Sound Equipment Corp., Syracuse, New York.



why TRU-WELD
is a stronger, better grating



photomicrograph of grating welds

This enlargement of the weld area in TRU-WELD grating shows how solidly the metals have joined. Cross bar and bearing bar have fused into a strong, moisture- and vibration-proof weld.

Enlargement of an incomplete weld area. Note the line of separation between bearing bar and cross bar. Heavy traffic and vibration can easily separate such a weld.

Tru-Weld grating is stronger because it is *made* that way. Its added strength comes from a manufacturing process that completely fuses the metal at cross bar-bearing bar joints and holds the bars to exact spacing. The result is grating that stands up under excessive vibration, heavy traffic or in areas where corrosive fumes and moisture are a problem. And Dravo Tru-Weld grating *costs no more*.

Complete estimating, layout and fabricating services are available. Immediate delivery from stocks maintained at nearby Joseph T. Ryerson Service Centers will help you meet exacting construction schedules.

For more information on this new, stronger grating, call the Dravo representative in your area, or write DRAVO CORPORATION, PITTSBURGH 25, PA.

DRAVO
CORPORATION

of the five regions of the Bureau of Public Roads, will also hold a discussion meeting with BPR officials on matters pertaining to secondary roads during the week. A series of other topics to be discussed includes new techniques in highway engineering and construction, drainage and zoning problems, and accounting practices.

Federal Highway Administrator, Bertram D. Tallamy, reports that more than one-fifth of the 41,000-mile Interstate Highway System is now open to traffic. As summer began more than 9000 miles of the divided, multi-laned expressways were being used.

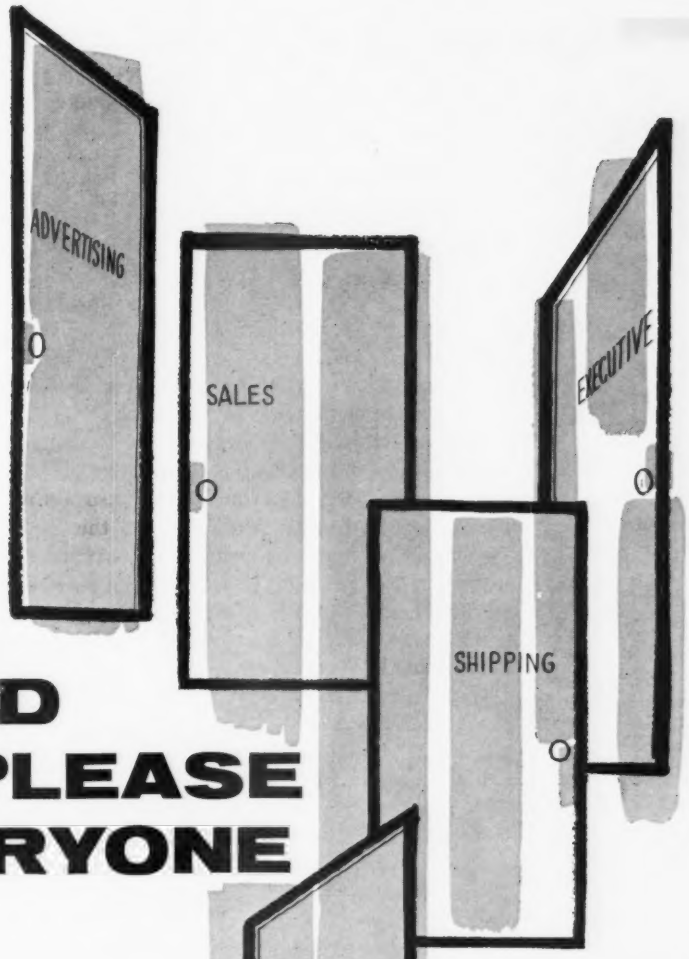
Highway Lighting Research

The Highway Research Board's special Committee on Night Visibility is urging an all-out research program on freeway lighting. Highway administrators, facing increasing demands for lighting along the great interstate system, assertedly need an impartial research evaluation on the effects of freeway lighting on accidents, driver behavior, traffic flow, and capacity; and highway lighting costs in relation to traffic benefits.

If lighting is justified, highway administrators also need impartial research findings as to the desirability of lighting only certain zones (such as interchange areas) compared with lighting continuous freeway mileages; intensities of lighting warranted for various situations; and kinds of lighting installations, mounting heights, lighting pole locations, and spacing.

Know These Lending Agencies

American consulting engineers are now interested in the functions of seven lending agencies to which our country contributes capital for loans to underdeveloped countries. These are the Export-Import Bank, Development Loan Fund, World Bank, Inter-American Development Bank, International Development Association, International Monetary Fund, and the Interna-



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From one central cabinet here's individual year 'round comfort conditioning to suit **many** different areas of a building. Each zone is controlled automatically. Consider these exclusive *Buffalo* features:

RUGGED TUBULAR FRAME — easily assembled and installed. Convenient to service thru handy access doors, removable panels and outside bearings.

CHOICE OF COMBINATIONS — floor or suspended mounting arrangements — any combination of heating, cooling or humidity control.

LOW HEAD ROOM due to 45° pitched coils.

PERMANENCY—DEPENDABILITY — heavy-gauge, corrosion-resistant paneling, coils, pans and dampers; high-quality backward curved limit load fans; heavy-duty ball or sleeve bearings.

Exclusive individually sized damper zones to accurately proportion quantity of air flow.

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Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

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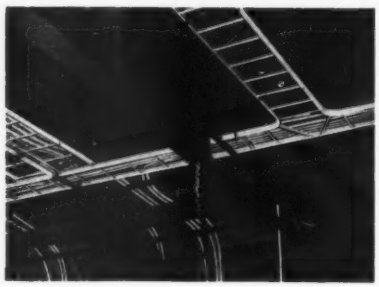
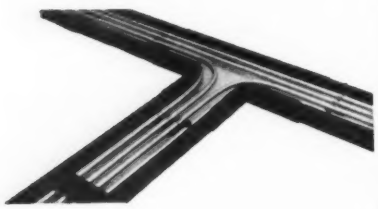
● The first cost is lower . . . The Life is longer . . . The material is stronger! Your best buy for fast installation and superior performance is Chalfant Aluminized Steel Cable and Tubing Racks with exclusive boltless crimp-type splice plates.



● 17 year tests prove a life 3 years longer than standard zinc coating on galvanized steel . . . Chalfant Aluminized Steel Cable Racks have a higher heat resistant rating than galvanized steel . . . In salt spray tests, aluminized steel lasted 3 times longer than galvanized steel!



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tional Finance Corporation, which is a subsidiary of the World Bank.

The newest lending agency, International Development Association, will have a capital of $1 billion of which $320 million is scheduled to come from the United States.

NBS Headed for Suburbs

Work will begin within the next several months on site development and construction of the first three building units of the new National Bureau of Standards' laboratories to be located on a 550-acre tract near Gaithersburg, Maryland, 20 miles from the District of Columbia line. Congress this year appropriated $23.5 million to finance the initial phase of the relocation of the Bureau which is now located in residential Washington.

The Bureau estimates that the total cost of the relocation program will be $104 million. Completion of the program is estimated for 1965. The first building phase will be construction of an engineering mechanics laboratory, a radiation physics laboratory, and a power plant. The new site was selected, after careful consideration, as the one most suited to the special requirements of the Bureau's scientific and engineering program.

Highway Materials Shortage?

A shortage of high grade sand, gravel, and crushed stone looms ahead for highway engineers. The Highway Research Board, as a result of the diminishing supply of desirable aggregates, is urging that $10 million be spent on research in an effort to find replacements.

National trade associations for the sand and aggregate industry in Washington concurred with the Board. However, they agreed that the great highway construction program under way will not be slowed down for the next several years because of the shortage of high quality aggregates. While construction engineers are demanding stricter specifications for new projects, a spokesman for the National Sand and Gravel Association acknowledge that "prime deposits" of sand and gravel across the country are diminishing.

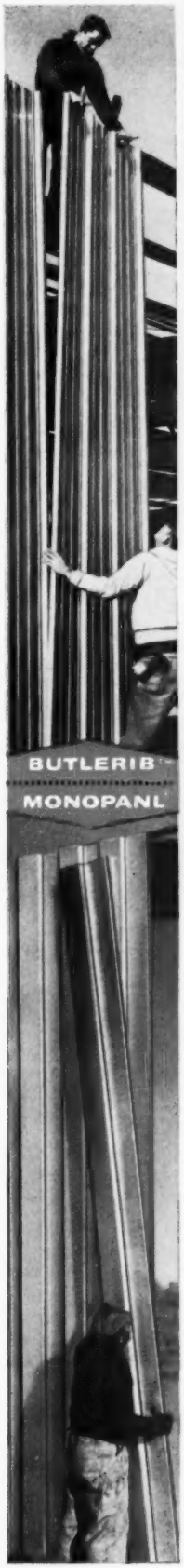
Possibly nuclear energy may transform clays and other now undesirable materials into useful aggregates, said the Research Board. It added that the strengthening of soils through chemical stabilization and development of better means of removing water or eliminating its effects can produce large benefits. Improvement of understanding of the physio-chemical properties of soils through new techniques in the laboratory, use of radioactive isotopes to trace movement of water in or under the surface structures, use of nuclear devices to measure soil density and moisture and to aid in controlling compaction of fills, offer much promise, the Board insists.

R & D Directory

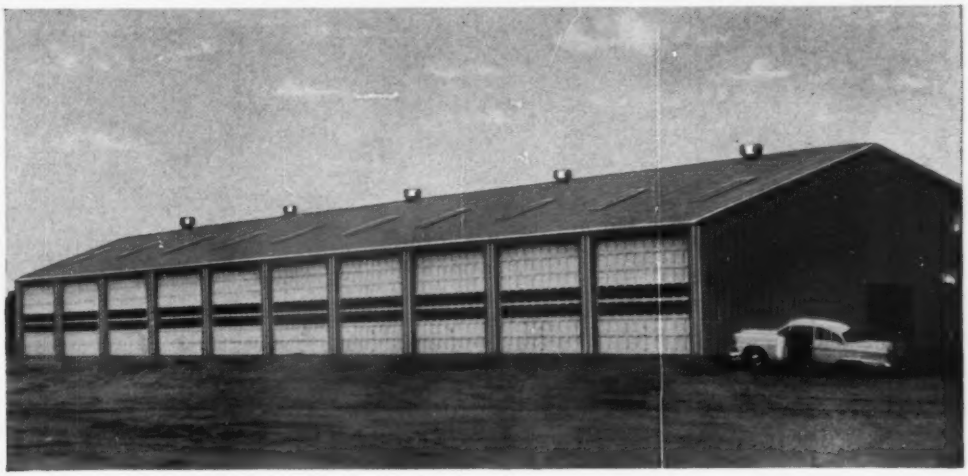
A directory listing 2674 small businesses qualified to do research and development work in 33 major categories as prime or subcontractors has been issued by the Small Business Administration. Prepared for use by government purchasing agencies and private groups interested in research and development, copies are available for public inspection at all SBA field offices.

The directory, titled "A List of Small Business Concerns Interested in Performing Research and Development," includes information on each firm's field of interest, area of specialization, previous experience in research and development, and technical services, as well as the number of engineers, scientists, and technical employees of each company.

Expenditures by the United States government on research and development is now big business and getting bigger. It is estimated that the various departments and agencies will spend more than $8.3 billion for such work during the 1961 fiscal year. ▲▲



A BUTLER BUILDING EXCLUSIVE...CHOICE OF TWO SUPERIOR WALL PANELS IN COLOR



Buildings that don't tax your budget
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Big or little . . . plain or fancy . . . there's a Butler pre-engineered building to meet the requirements of your community. These examples are typical of the hundreds of buildings throughout the United States that have been built by many progressive, cost-conscious communities. They all have three important advantages: Clear-span interiors that offer maximum use of inside space; load-bearing rigid frame structurals that permit complete freedom in construction and design of outside walls; and mass production economies that result in money-savings for the taxpayers.

Whether you need a "shirtsleeve" building for maintenance use or a "monument" with a handsomely designed exterior, there's a Butler building to fit your needs. And, metal buildings are not all alike! We invite you to compare Butler's two superior new wall systems with all others designed for pre-engineered structures . . . Butlerib, the new improved standard wall and roof panel, and Monopanl, the exclusive, factory-insulated curtain wall. You'll find they're the finest. Or, your Butler Builder will be happy to work with your architect in using a wide variety of curtain wall materials – such as glass, wood and brick.

Why settle for less than the best . . . build with Butler, the lowest cost way to build well. Before you build, call your Butler Builder. He's listed in the Yellow Pages under "Buildings" or "Steel Buildings."

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Complete Underfloor Electrification—Place E/R (Electrically Ready) Cofar units between standard Cofar sections. These large cells carry power, phone, signal circuits direct to desks and machines *anywhere* on the floor. Use any desired spacing of one-, two- or three-cell units to get complete electrification where it is needed, when it is needed.

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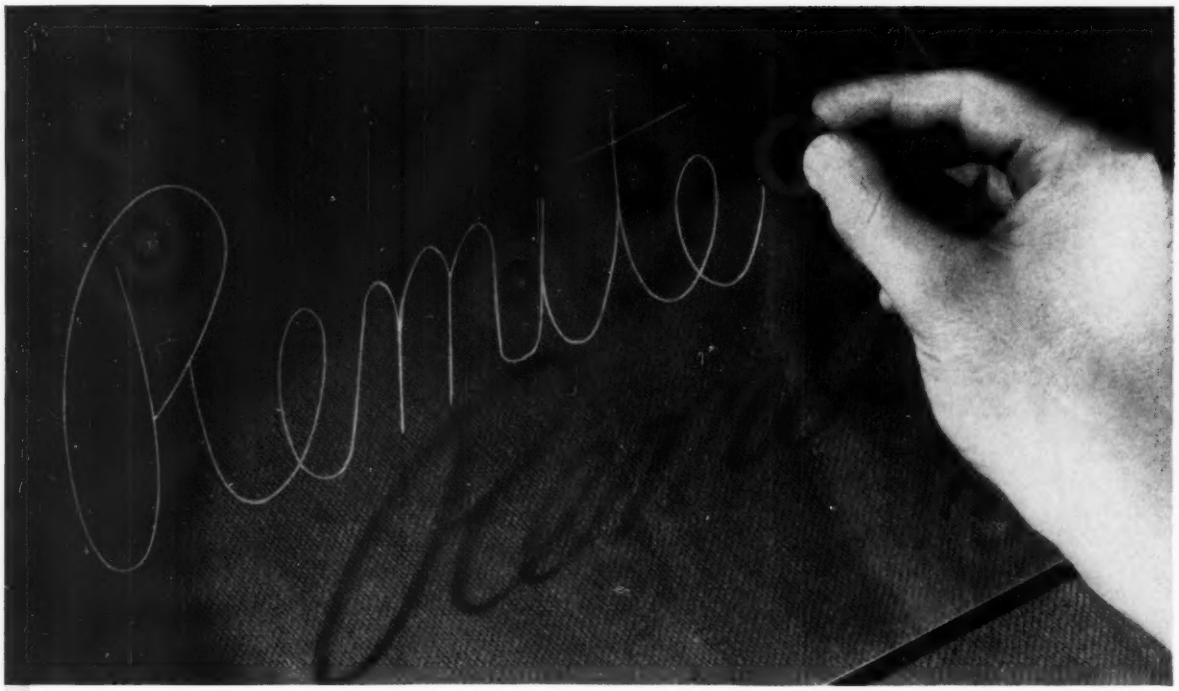
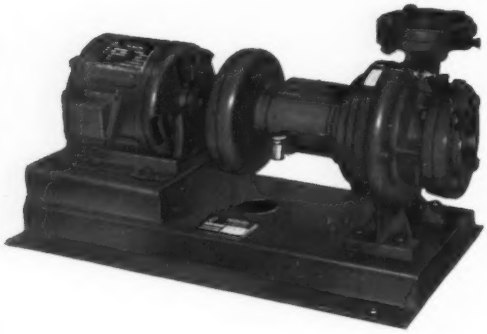


How the REMITE® seal in

B&G® centrifugal pumps

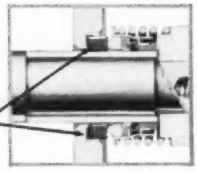
assures leak-proof operation



A new material, called "Remite," developed in the Research Laboratory of the Bell & Gossett Company, simplifies the problem of keeping water out of the bearings of centrifugal pumps.

"Remite" is almost diamond-hard...easily cuts glass... corrosion-resistant as well as wear-proof. In all B&G Universal and industrial pumps it is used as a floating seat facing a carbon seal. This unique combination eliminates pump leakage and gives trouble-free service even when the pumped liquid contains foreign material.

"Remite" is also produced commercially for a wide variety of applications where hardness and wearing qualities are important. It has high flexural strength and is resistant to chemical attack and high temperatures. Electrical insulating properties are good at both high and low frequencies.



Position of "Remite" Seal as used in B&G Universal Pump—a unit noted for quiet operation.

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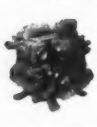


Refrigeration Compressors

Marlow Pumps

Heat Exchangers

Oil-less Air Compressors

Heard Around Headquarters

MARJORIE ODEN,
Eastern Editor

VERBATIM from a recent issue of the *Metropolitan Washington Professional Engineer:* "The functional Section for Engineers in Private Practice cordially invites *all* engineers, especially those in the government who do outside consulting work, to attend the March 28th meeting. Clarification of the Registration Act, fee schedules, tax considerations, the Consulting Engineers Council, and other pertinent matters will be discussed.

"It should be stressed that enrollment in more than one Functional Section is to be encouraged if the individual's interests exist in more than one group. This is particularly true in our local Society, since many of the government-employed members can and do consulting work in their specialties outside of their government duties, and thereby engage in private practice. The same may be true of our colleagues in education. Therefore, the organizing committee requests each member to review his position and determine the potential for affiliation with DCSPE Functional Section for Engineers-in-Private-Practice."

New FIDIC Member

The Association of Consulting Engineers of Ireland became the 15th member of the International Federation of Consulting Engineers (FIDIC) at its recent meeting in Stockholm. During the past few years, FIDIC has added United States, Canada, Australia, and South Africa consulting groups to the original Western Europe members. The U. S. organization belonging to this international body is Consulting Engineers Council.

The Red Tape Curtain

George Bajos, the Hungarian engineer who has had 16 years experience and is the author of eight technical books, lost his battle to take the New York registration test. ("Field Notes," May 1960).

George, a full member of the American Society of Civil Engineers, has been required to submit more than 65 pages of documents to prove his credentials. After trying since last October to be allowed to take the test and providing all data required, George was notified that he will not be able to take the test because he did not apply in time.

So George will have to remain at his $5500 a year job and try again next November.

Replies to Consultants

Senator John Hughes of Syracuse, source of most of New York consultants' troubles for the past year, was the star attraction at the recent annual meeting of the New York State Association of Consulting Engineers.

More than one year ago, Senator Hughes began complaining about consulting engineers on state projects. ("Field Notes," April 1959). Then, early this year, his one-man committee counsel "accidentally" lost a copy of a detrimental report on consultants to the press.

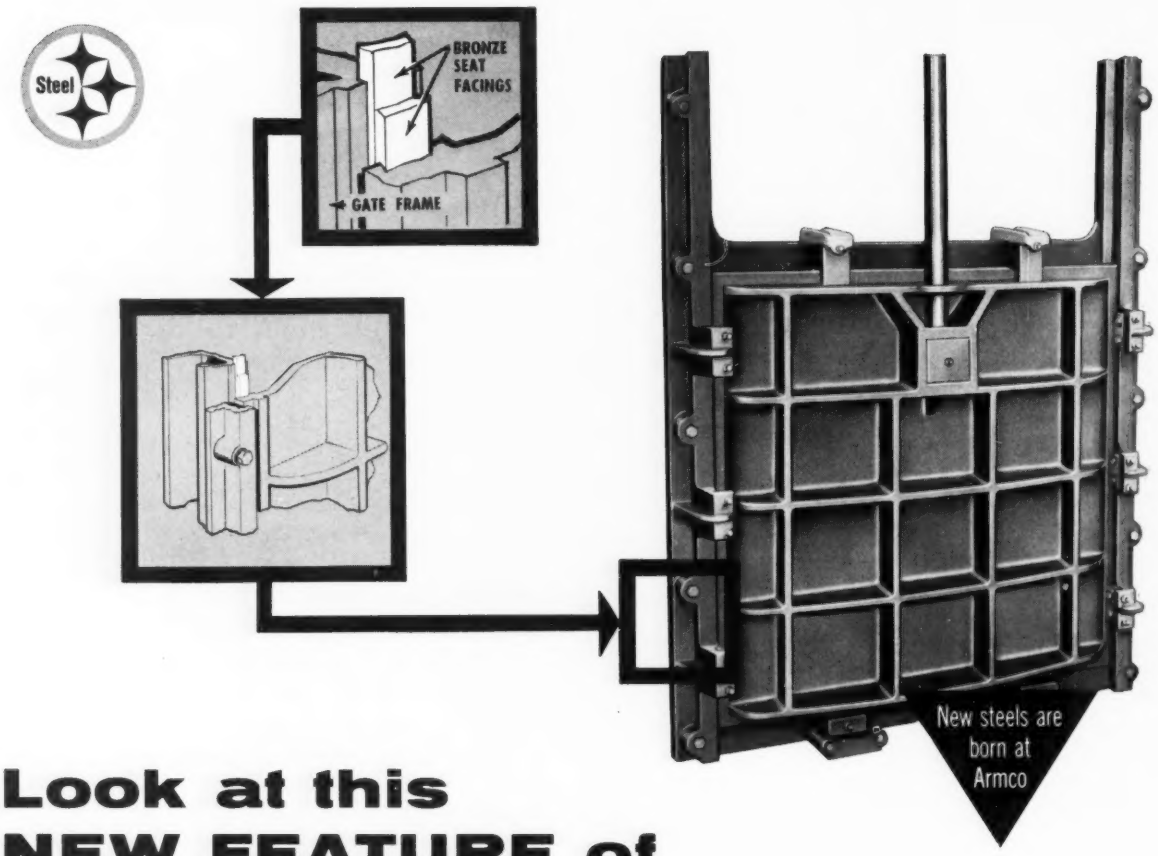
The State Association and the New York State Society of Professional Engineers both sent protests to the Senator, asking him to substantiate his charges or to withdraw them. He never replied to the letters.

Although he considers himself the victim of a "substantial area of misunderstanding," at least the Senator did not duck the issue. He said Carroll, his committee counsel who authored the controversial report, "did what he was supposed to do. And I did what I wanted to do."

The Senator's only regret is that he was unable to get a closed hearing held to investigate the awarding of contracts to consultants.

Senator Hughes also stated that he has been misquoted . . . he never did say he was in favor of competitive bidding. (The Albany *Times-Union* quoted him as explaining that he "objected to the procedure under which the Superintendent of Public Works had sole authority to let a design contract to a consulting engineering firm without advertising for bids or giving public notice.")

However, Senator Hughes told consultants that they are at fault, in at least one respect, for any legislative worries they have. "Too many people know practically



Look at this NEW FEATURE of Armco Sluice Gates

Now you can get Armco Sluice Gates with bronze seating faces tightly anchored into dove-tailed grooves on both the slide and the frame. Both edges of the seating faces have the support of their beveled sides, with no overhanging surfaces. The actual bronze seating surfaces are machined perfectly flat for maximum watertightness.

This is just one advantage of Armco Sluice Gates. Others of special interest to engineers are: flush bottom opening; adjustable wedges; and a choice of metals for mounting materials. Then too, Armco offers you the world's widest selection of sluice gate sizes. See table for condensed data.

For more information on Armco Water Control Gates, write us, mentioning the type of gate that interests you. Armco Drainage & Metal Products, Inc., 6430 Curtis Street, Middletown, Ohio.

SIZE RANGE
and permissible unbalanced heads

Type of Gates	Sizes		Permissible Unbalanced Head	
	Round Openings	Square and Rectangular Openings	Seating in feet	Unseating in feet
Sluice Gates	6″ to 120″ diameters	6″ x 6″ to 108″ x 108″	5′ to 100′	0′ to 30′
Flap Gates	4″ to 90″	24″ x 24″ to 96″ x 96″	10′ to 50′	—
Roller Gates	—	9′ x 6′ to 30′ x 12′	0′ to 15′	0′
Radial Gates	—	8′ x 3′ to 20′ x 7′	0′ to 10′	0′

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nothing about consulting engineers because you live in a world all your own." He advised consultants to get acquainted with their legislators, and to explain their problems because "we can't be experts in everything."

For instance, in connection with a recent bill to approve standard plans for schools in New York State "the only people I heard from were the architects, and this is the first time I had seen them in my 14 years as a Senator."

Realto Cherne of Syracuse, new State Association president, outlined his aims for the coming year — increase in membership, better architect-engineer relationships, more accent on legislative activities, determine more effective ways to handle ethics problems, better public relations, closer contact with the New York Association of Consulting Engineers, and continued cooperation with the Consulting Engineers Council.

The State Association has produced the first half of its own Manual of Practice — covering engineer-client relationships. The second half will deal with interprofessional practice and is scheduled for completion early this year.

The State group also has dropped membership in the Empire State Chamber of Commerce after deciding they were getting nothing for their money.

Binghamton joined, making five member chapters.

And the constitution and bylaws are being revised in such a manner that individual chapters no longer will need separate constitutions — only bylaws.

This year, the State Association favored a bill which would have legalized engineer-surveyor partnerships in New York State. There does not seem to be a total agreement among Association members on this, and the NYSSPE opposed the bill (which did not pass). The State Association queried other CEC member groups. Half answered, and all said engineer-surveyor partnerships are allowed in their states.

Most of the discussion was in regard to how to "clean up" the classified listings of consulting engineers throughout the state. No ready solution was found, but all chapters as well as state officials are continuing the studies.

Doing Very Well

By annual meeting time last month, the American Society of Heating, refrigerating, and Air-Conditioning Engineers was able to announce it now is the fifth largest technical society — topping one of the Founder Societies, the American Institute of Chemical Engineers. ASHRAE now has 20,000 members.

Fisk Joins ASCE Staff

John H. Fisk, of Franklin Park, New Jersey, has been named assistant to the secretary of the American Society of Civil Engineers, it was announced by W. H. Wisely, executive secretary. Fisk's assignment will be the Society's vast network of Student Chapters, as well as working with younger members.

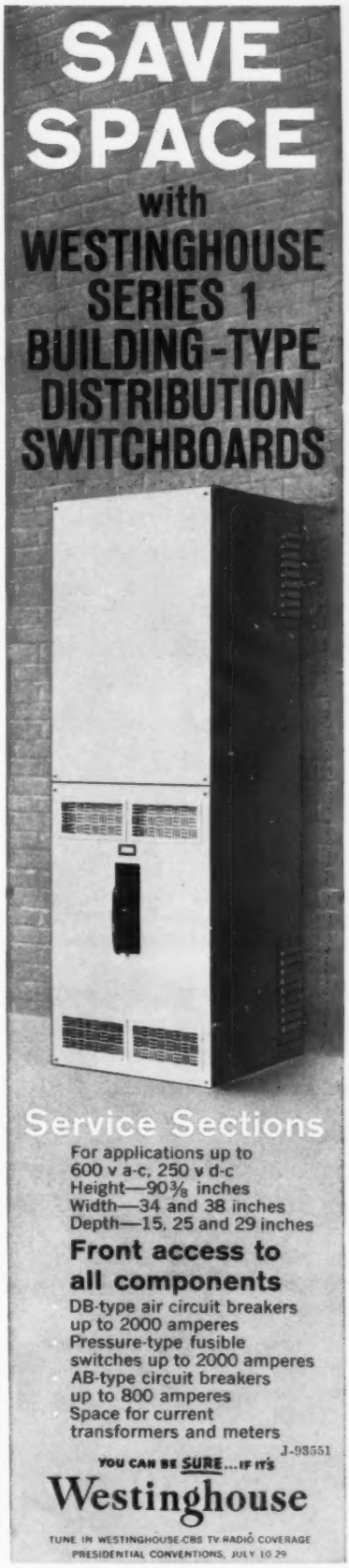
A graduate of Rutgers University in 1954, Fisk served three years as a pilot in the U. S. Air Force. On his return to civilian life, he was associated with a New York consulting engineering firm for two years before joining ASCE.

Canadian Council Elects

New officers were elected at the Canadian Council of Professional Engineers' annual meeting in Saint John, New Brunswick earlier this year. President is J. Graham Dale; vice president; W. L. Wardrop; member of the executive, D. S. Simmons.

NYSACE Officers

At the third annual meeting of the New York State Association of Consulting Engineers, Inc., held in Syracuse on May 27, the following officers were elected for terms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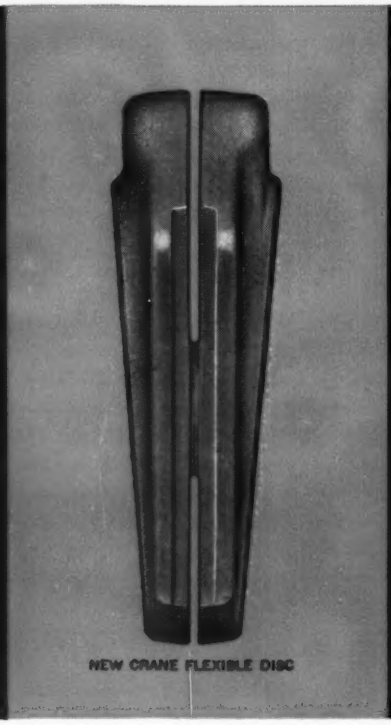
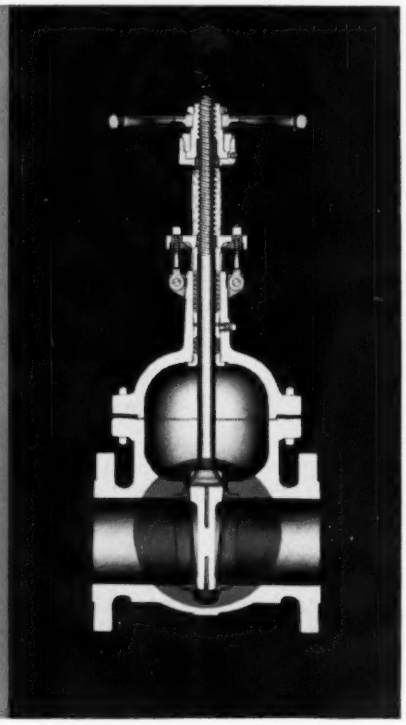


NEW CRANE FLEXIBLE DISC



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BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates can be used singly in some services where two conventional gate valves are frequently specified. You can save substantially on piping costs.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates can be serviced—body seat rings replaced or seating faces refinished—quickly, and without painstaking accuracy. Slightly off-taper seats do not affect tightness or operating ease.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates will easily outperform any conventional solid wedge disc valve you now use. *And there's no increase in price.*

BECAUSE THEY'RE MADE BY CRANE, these new Flex Gates are completely dependable. You can use them with complete confidence on steam, water, gas, oil or oil vapor service. Stem and disc seating faces are Crane Exelloy. Shoulder-type body seat rings are Exelloy or Crane No. 49 Nickel Alloy. Sizes: 12 inch and smaller; 150- and 300-pound pressure classes.

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of one year: president, Realto E. Cherne, Rochester; vice president, A. Gordon Wheler, Cazenovia; and secretary-treasurer, Robert Holzmacher, Hicksville, Long Island.

At the same meeting, Frank E. Kulas of Rochester was elected to serve as director to the Consulting Engineers Council. In this capacity, Kulas will represent NYSACE on the board of directors of CEC. James N. DeSerio of Buffalo was elected as alternate director.

Foundation Adjusts Focus

The Engineering Foundation, largely identified with research projects which it supports with the little money it has available, is taking another look at its aims and planning some basic changes.

According to the new executive director, Dr. Harold K. Work, the Foundation in the past has made many small appropriations to a considerable number of research projects. In some cases, the Foundation also has continued token support of research projects for many years even though the projects have found adequate funds elsewhere. But since the Foundation budget is only about $85,000 a year, too little money spread too thin has left much to be desired.

"Today the problem is not to find money for research but to define important problems and find competent men to carry them out," the Board reported. However, there still is some feeling among Foundation board members that more money should be raised and the sponsoring of research programs continued.

Electronic Recruiting

Recruiting engineers at conventions has gone modern. With the new Career Centers, an engineer can walk into a central reception room if he is curious about what jobs are around. He gives his resume to Center personnel. The resume — without the applicant's name — is flashed by teletype to waiting recruitment offices in other parts of the hotel. Anyone interested in hiring the man answers — also by teletype — and an interview is arranged. Of course, the engineer sees the name of the firm before the interview so there is no danger of his applying for a job with his own firm.

The first Career Center was held this year at the Institute of Radio Engineers meeting in New York City. Almost 1500 engineers and scientists registered for new jobs, and approximately 27 firms were recruiting.

Next Career Center will be held in August at the IRE's Western Electronics Show and Convention in Los Angeles.

Florida Engineers to Build

The Florida Engineering Society plans to construct a building of its own in Tampa — soon.

According to the Society, plans and specifications are nearing completion, a site has been chosen, and the project awaits only the sale of an authorized $60,000 bond issue to Society members.

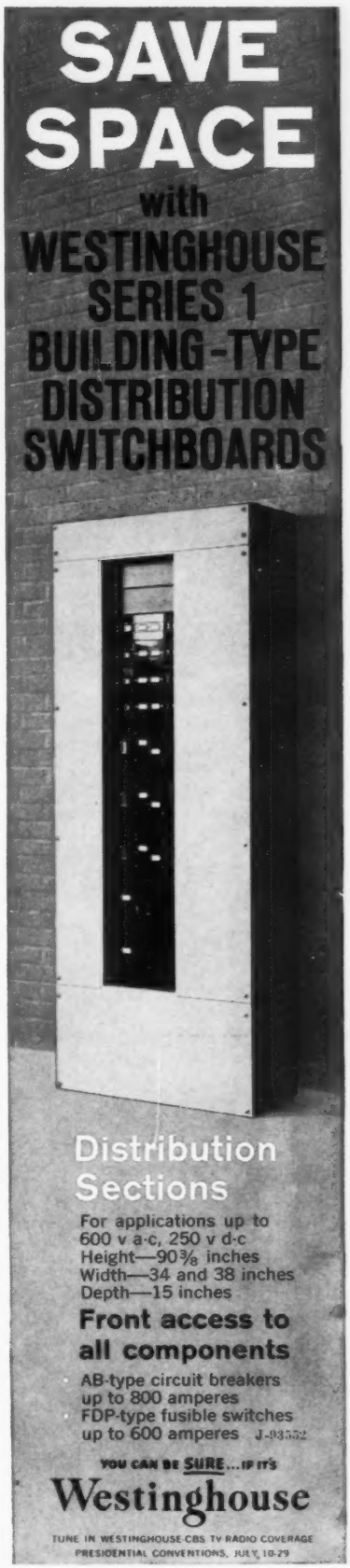
The proposed building will be a one-floor plan, so designed that a second floor can be added when desirable. The building will house offices for the executive director and his clerical help, records storage space, and a board of directors meeting room.

The Florida Engineering Societv dates back to 1917. Five years ago, the FES amalgamated with the Florida Society of Professional Engineers and now is the state affiliate with NSPE.

Civil Engineering Curricula

Consulting engineers will get their chance to express views on what young civil engineers of the future should be taught in college. A conference, to decide the future of civil engineering curricula, will be held July 6 through 8 at the University of Michigan.

For some time, civil engineering courses have been in the limelight ("Heard Around Headquarters,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November 1959), but previous meetings had been held on an ivory tower level frequented only by professional educators. The Michigan sessions will hear all who want to express opinions.

The first in this series of conferences was held last winter, when about 25 educators met at Cooper Union's surveying camp in New Jersey. It was sponsored by the American Society of Civil Engineers and the American Society for Engineering Education.

Then last month, the American Sanitary Engineering Inter-Society Board joined ASCE and ASEE to sponsor a gathering of Harvard and Massachusetts Institute of Technology teachers to discuss the sanitary engineering curricula. MIT also is studying the entire engineering curricula on a large Ford Foundation grant.

Expected recommendations of the Michigan meeting — a five-year course for a civil engineering degree. Bachelor's degrees would be awarded under this plan at the end of the fourth year.

Policy on Testimony

The American Institute of Architects has adopted a change in its constitution making it the stated duty of all members and chapters to "be willing to offer testimony in support of every case of alleged unprofessional conduct of which he or it is cognizant . . ."

Not Mentioned in Contracts

Joseph Weiss, superintendent of New York's Board of Education bureau of construction, no longer is requiring architects to include the engineers' fees in contracts.

According to the New York Association of Consulting Engineers *Newsletter*, "The (Association) Committee feels that as the overall fees to architects for new work have been decreased from year to year and Mr. Weiss is no longer requiring that engineer's fees be mentioned in contracts, our members will no longer be able to accept Board of Education projects, unless a drastic change is made."

In dealings with the Board of Education, consulting engineers now are better off in one small area. Weiss has reported that separate contracts will be awarded consulting engineers on mechanical work included in alterations to existing buildings.

CEASO Elects New Officers

The Consulting Engineers Association of South Dakota, at its annual convention in Rapid City, named Julian Staven of Rapid City, president, succeeding Frank Sheridan, Sioux Falls. Calvin Vaudrey, Brookings, was elected vice president; Waldo L. Scott, Watertown, secretary-treasurer.

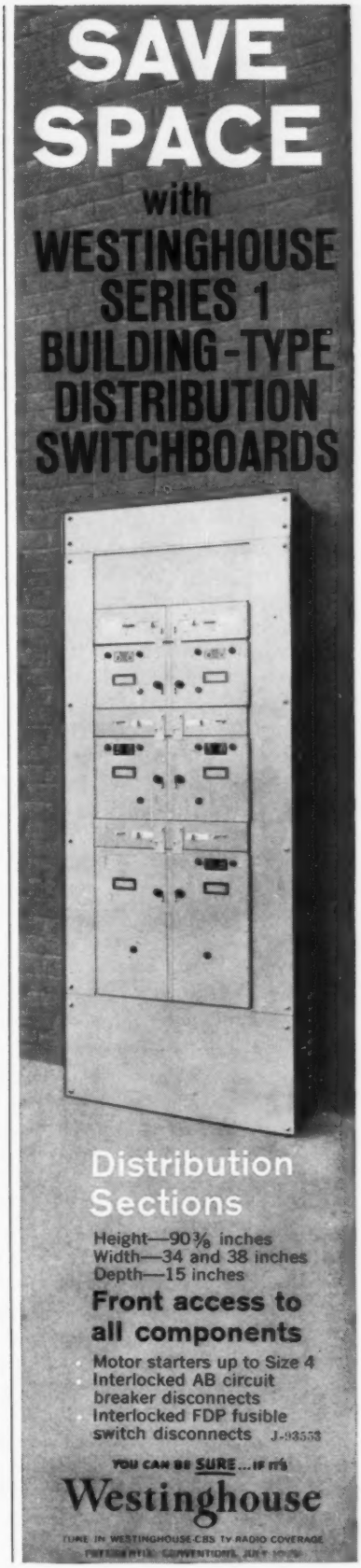
Donald Flahart, Rapid City, was named director for a two-year term succeeding Arthur Mannes, Aberdeen; Frank Brady, Spearfish, replacing Fred Brady, also of Spearfish. Two hold-over directors are Ray Roby, Mitchell, and John Reese, Watertown.

Campbell Again

Comptroller General Joseph Campbell, of the General Accounting Office, has taken another swipe at the use of consulting engineers by highway departments.

Speaking before a subcommittee of the House Appropriations Committee, Campbell said, "The extensive use of consulting engineers for the usual types of engineering work, which in other states was done by state employed engineers, substantially and unnecessarily increased the cost of that engineering and resulted in an avoidable inequity among the states in the extent of Federal participation in engineering costs."

Campbell was referring to the District of Columbia Highway Department this time, which protested that using consulting engineers is saving them money. Again, Campbell presented no figures in support of his "excessive costs" claims. ▲▲



"Quote . . . End Quote"

A Professional Monopoly?

"Few people realize the teeth contained by laws that give professional organizations their power. For instance: if proposed legislation is passed in Quebec, I would become liable to legal action if I called myself a chemist without joining the provincial professional chemists association. Suppose, from the point of view of the public safety, this is a good thing. I should be forced to prove to the association, or the courts, that I am a graduate in chemistry from a recognized university — which I am. And if this were not satisfactory, I should be forced to take and pass their qualifying examination — which I trust I could.

"Then is not the public interest served? Is not the public secure? Not according to the proposed law. If I stop making my annual contributions to this society, I lose my right to call myself a chemist. And . . . I run a risk even *describing* myself as a chemist.

"I said something about bilking the public. I don't mean to imply that doctors, or engineers, or chemists, lobby for these laws in order to bilk the public. But how would you like it if only a legally registered repair man could fix your TV set? If only a certified tax expert could make out your income tax, and you weren't allowed to do it yourself? If it became a crime to cut your children's hair at home, and the giving of a home permanent to another person became an offense under law?

"We haven't yet come that far, but we'd better watch ourselves." — Charles R. Graham, from an article in *Saturday Night*.

U. S. Not Built By Timid Souls

"Most of our country's progress has come through a spirit of boundless confidence and optimistic disregard of the consequences of failure. There is hardly a successful venture in our history, industrial or national, against which excellent arguments, highly logical arguments, could not have been advanced at the outset . . .

"Fortunately, the optimist has always prevailed. Progress is never the product of pessimism. Vigorous institutions in science, in business, in government, or the arts, are monuments to affirmative thinking, not to the sober head-shaking 'no.'

"If education can provide a clear picture of personal responsibility and of personal initiative, then we can be sure that we will use our science wisely and not permit it to be obscured behind a dust cloud of irrelevant and superficial considerations.

"In this sense, the teachers, and the teachers of teachers, have a very special responsibility. It should be the teacher's responsibility to make clear those fundamentals which are at the core of a progressive society. For the goal of sound education is not how much we shall know, but how we shall use what we know — it is not the shaping of the intellect that is the prime object, but the shaping of human character.

"If young people are deriving less from their exposure to education than they should, I think it is because they have fallen victim, along with many of their elders, to a philosophy which has for many years held that success by one's own efforts is less to be desired than a collective security — a philosophy which, in a word, has suggested that the world owes everyone a living . . . " — Henry B. du Pont at the dedication of a new science building at *Sul Ross State College*.

Socialist Inroads on Research

"Industrial research is an essential function that has been responsible for much of our industrial growth, the improvement of living standards, and the making of a strong nation. Results of such applied research are rightfully the property of only the sponsor. But applied research is as much a part of business operation as is any other phase; it is the private utilization of a professional service the same as legal or accounting services.

"Industrial research is rightfully used for competitive advantage and cannot, under any stretch of the

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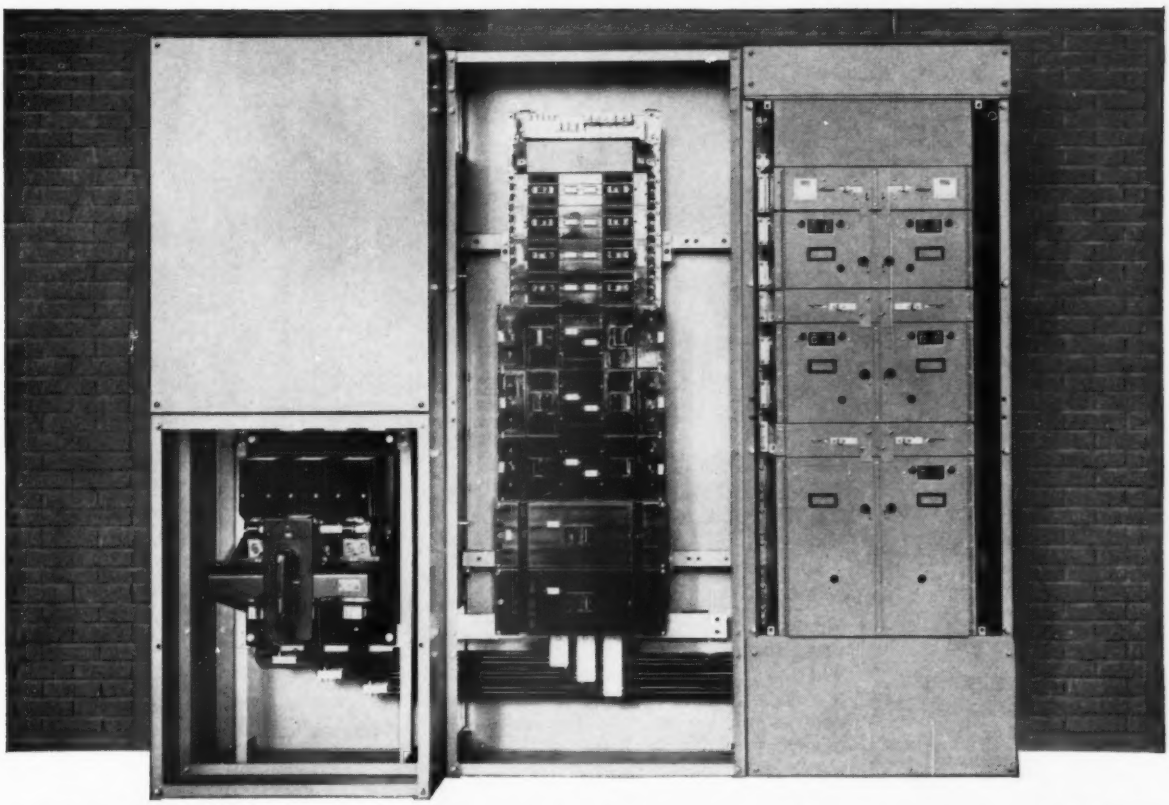

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Thermal Protection Against Overload — motor cuts out before damage can occur.

New Worm Gearing for highest efficiency and longest service.

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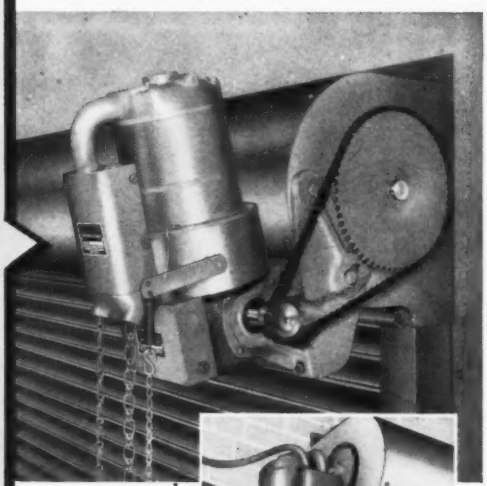

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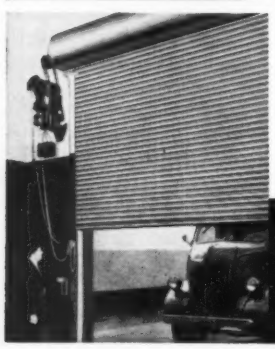

KINNEAR
ROLLING DOORS
Saving Ways in Doorways

imagination, be considered a public service. How, then, can anyone honestly consider industrial research as anything other than a form of professional business which should be subject to all forms of taxation?

"Research-conducting universities and research institutes can provide a valuable service to their community and to the nation, but they cannot do it by operating commercial businesses. I suggest they return to the field of basic research for public good – those responsibilities for which they were founded and which are needed so badly. Their tax-exempt status should be kept intact as long as they continue to do basic research with results immediately available to the public, except in those cases where national security is involved.

"On the other hand, the independent laboratory profession should have no objection to having research institutes as competitors in the applied research field, providing they do not confuse the public by adopting the name of some university and providing they pay their fair share of the cost of government through equal taxation.

"The independent tax-paying laboratories will continue to challenge the status of any tax-favored group which poses as serving the public without providing access to findings by qualified persons at all times, except those involving national security." – Roger W. Truesdail, from an article in *Industrial Research*.

New Forms for Thin Shells

"The use of Styrofoam as a construction aid in the fabrication of thin shell concrete structures could well prove to be one of the most significant advances in building technology since the advent of curtain wall construction. The construction economies and architectural freedom which can be simultaneously achieved with this new technique will certainly expand use of these new buildings far beyond

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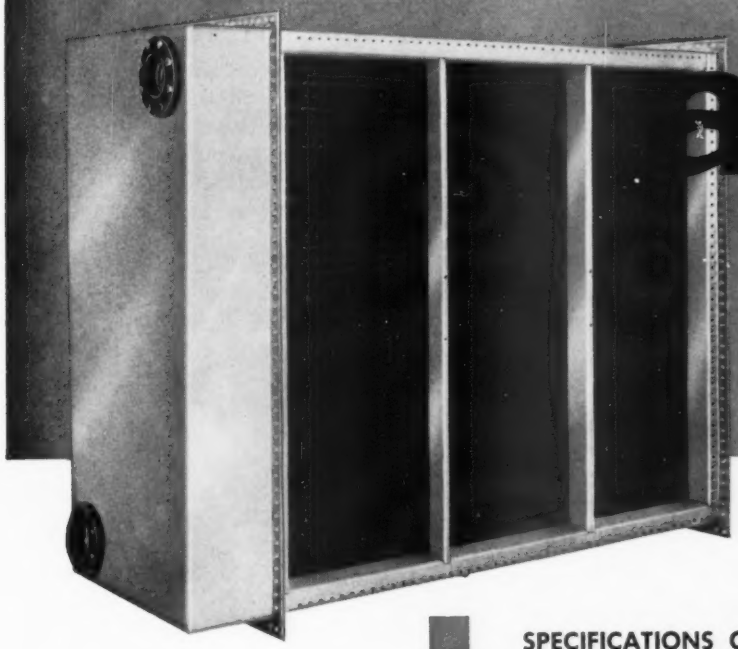

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Spacing: 1½″ center to center, staggered

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Spacing: 8 per inch

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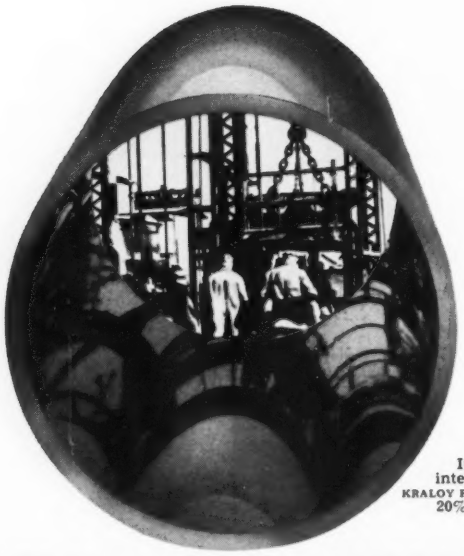

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their present rather narrow limits. It represents one of the most intelligent and rational combinations of the dynamic field of plastics technology with that of civil engineering which has yet occurred." — Frederick J. McGarry, of *MIT*.

Prescriptions for Steel

"Unfortunately, we are not getting the use we should be getting out of them [penicillin steels]. For one thing, we are limited by the imagination and creativity of professional men who still think in terms of the standard carbon steels and whose designs never go beyond their possibilities.

"In Europe, as you probably know, the structural engineers usually work on a competitive basis. To succeed they have to get the most out of their materials and the best design out of themselves. In this country, the structural engineer is usually picked by the client, much as the patient picks his doctor.

"Now, we can argue ethically, that it is a fine thing for the engineer to occupy the same high professional plateau as a physician. But, don't overlook one fact — the patient assumes that his doctor knows all there is to know about penicillin — in fact, about all the wonder drugs. And, having faith in this assumption, he puts his life in his doctor's hands.

"Extending this parallel, just as we depend on the doctor to know his drugs, to understand their properties, and to prescribe them in the most effective manner, so we expect the design engineer to know our penicillin steels and to use them to the best advantage to meet a specific situation." — Austin J. Paddock, from an address to *The Engineering Society of Detroit*.

Growth of Soil Mechanics

"As proof of this growing interest in soil mechanics, there is now an International Conference of Soil Engineers held every four years. In 1957 the conference was held

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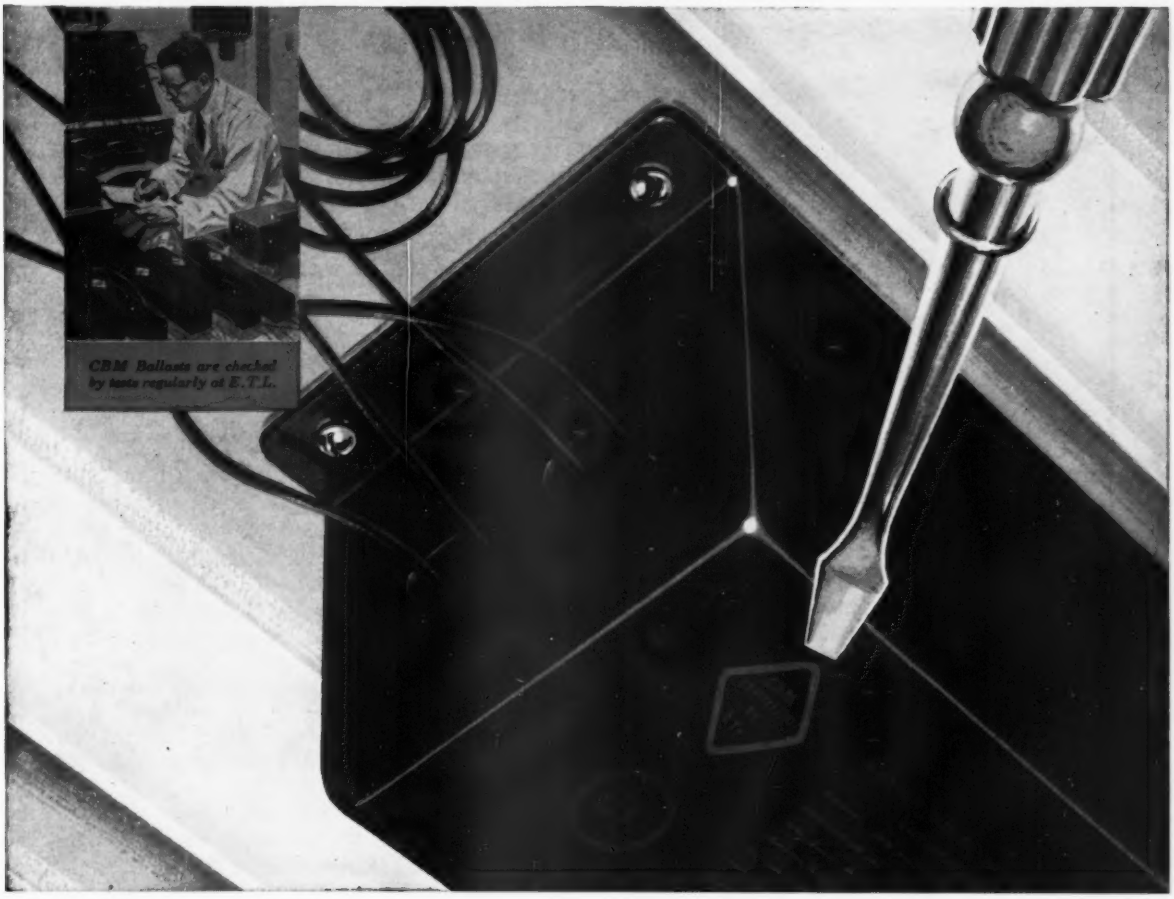
4-60



Among them . . . up to 40% more light output and sustained peak light output to give the benefits of today's recommended higher lighting levels. You also get long lamp and ballast life . . . positive starting . . . U. L. listing . . . **in short, performance that meets specified CBM standards** . . . checked and certified by Electrical Testing Laboratories. Enjoy CBM benefits on fixtures that you sell or specify. And to keep pace with CBM progress, ask us to start mailing you "CBM NEWS".

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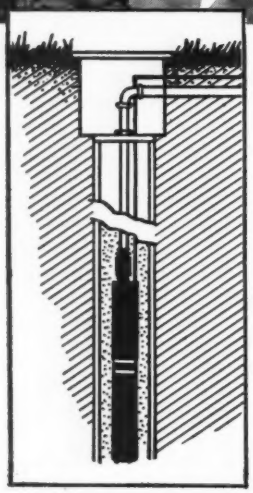
Picture of a 2000 gpm SUMO Submersible water pump installation!



Yes! That's the beauty of a Sumo Submersible. No pump house or other protection is needed to safeguard the motor against freezing, dampness or tampering. The Sumo Submersible operates completely inside the well — pump and motor both — under water.

The idea is not new. It's not radical. It's just plain commonsense engineering as Sumo has proved after almost 50 years of specializing in the submersible pump field. The motor is coupled directly to the pump and forms a complete, compact unit that makes more efficient use of power . . . provides a neater, simpler installation . . . and assures long, troublefree operation.

Sumo Submersible Pumps come in a full range of sizes up to 125 hp with capacities to 3300 gpm. Consider their use for any deep well requirement whether it be commercial, industrial or municipal. They'll quickly pay for themselves.

Write for information. **Ask for literature on Sumo high-capacity pumps. For specific recommendations, state your water requirements and the depth of the well. Engineering assistance is always available without obligation.**

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For pumping water containing up to 20% solids. Ideal for dewatering or flooding or use in areas where internal combustion engine driven pumps present a hazard. Capacities up to 400 gpm. *Write for literature.*

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in London, and in Zurich in 1953. In 1961 it will be held in Paris, and about 2000 soils and ground engineers are expected to attend from all parts of the world. At the Second African Conference on Soil and Ground Engineering, held recently in Mozambique, there were approximately 110 engineers, all anxious to exchange ideas and to learn of the latest developments in research and in the instruments which are now available to them. Recently in Berne, Switzerland, 300 soils engineers attended a one-day session, a remarkable attendance for a country considered to have a well developed road system.

"Interest in soil mechanics and engineering testing has grown tremendously in the past 10 years. From a few laboratories, there are now over 5000 engineering testing laboratories in the world. Engineering testing is excellent insurance against costly failures due to improper design and improper materials. With the ever rising costs of civil engineering construction, the use of testing facilities and proper evaluation of test results is considered a necessity." — John Robinson Davies, *Soiltest International, S.A.*

Engineers vs. Unions

"The overwhelming expression of Western Electric engineers against union representation is additional confirmation that the industrially employed engineer of today prefers a professional approach toward engineer - management relations, rather than that offered to him by unions.

"The National Society of Professional Engineers is particularly gratified by the large 'no-union' vote in this highly significant election because it emphasizes the soundness of the Society's position that collective bargaining for professional engineers is in conflict with the basic principles of a professional individual. We believe that Western Electric engineers will now be in a position to move

The homeowners campaigned for concrete!

In Indian Village, they paved 110 blocks of streets with modern concrete!

The Indian Village subdivision of Salina, Kansas, is a 5-year-old neighborhood of modest homes . . . and progressive homeowners!

Worn-out, potholed, all-but-impassable streets threatened to turn the area into a suburban slum. Neighbors got together to do something about it. They found they could have modern concrete streets, pay for them over a period of 20 years under the provisions of a new Kansas law.

Then they proved the durability of concrete to the city council, showed the monthly assessment against homeowners to be much less for concrete than for asphalt on a 20-year basis.

They got their concrete streets—110 blocks of them in the biggest street paving program ever in Kansas. And everywhere houses showed dramatic evidence of the village's new lease on life! Paint-up . . . clean-up . . . fix-up . . . villagers are taking added interest in their homes, show more pride in their attractive neighborhood.

And when the streets are paid for, they'll still be "new"—flat and smooth-riding as ever. Concrete is the one pavement that you can expect to outlast the 20-year assessment.

Thrifty concrete offers true economy for taxpayers, both today and in the future. If *you* are planning a street paving program, write for free literature—technical and nontechnical. (U.S. and Canada only.)

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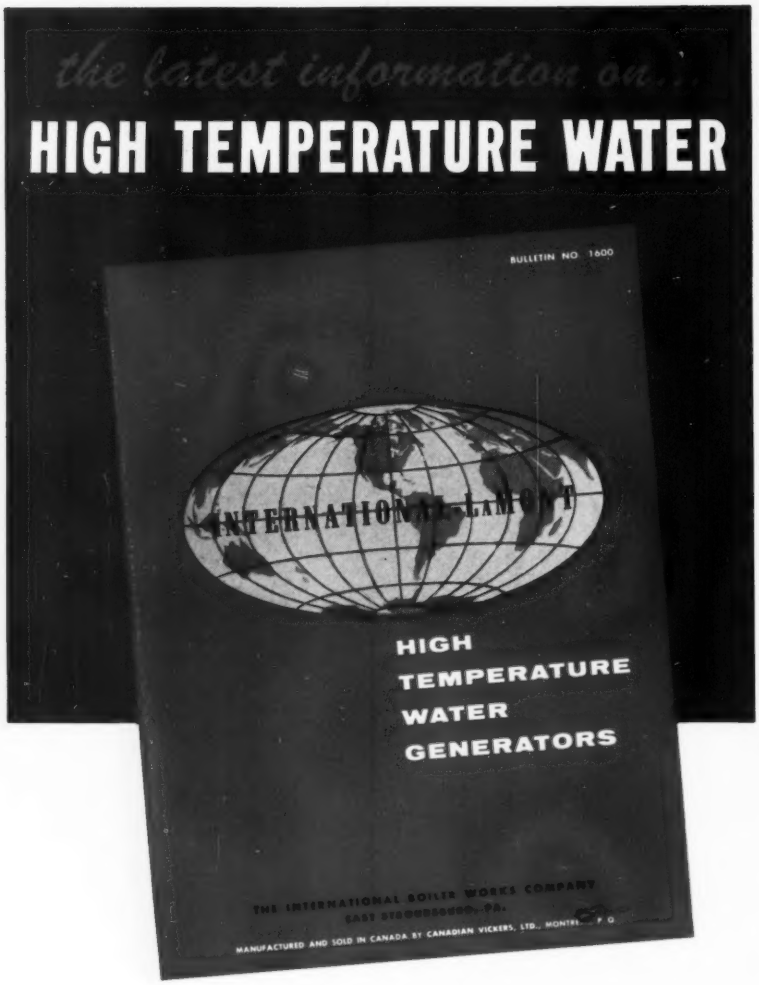

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ahead along professional lines and in accord with professional standards." — Harold A. Mosher, president of *NSPE*.

Does Not Favor Use of PE

"The most recent change in the Massachusetts Engineering Registration law may raise some questions as to the use of titles implying engineering status by individuals working in the field of engineering, or by employers concerned in the field of engineering. The following policies for dealing with these questions appear sensible:

"1. Employers should refrain from assigning titles implying engineering status to individuals believed unable to qualify for registration under the present Massachusetts law . . .

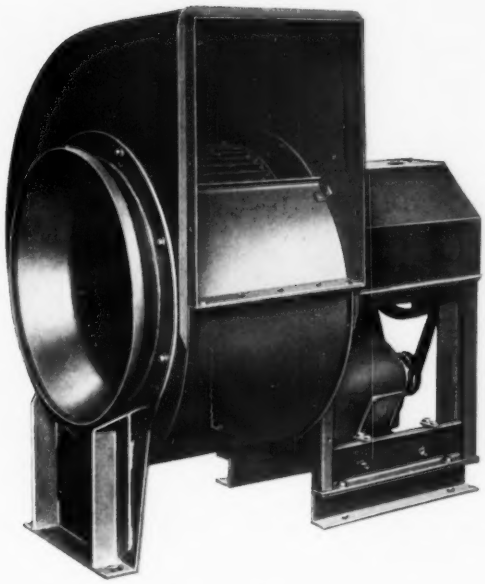
"2. In the light of the present law and the available interpretations of it, it appears that acceptance by an unregistered individual of an assigned title implying engineering status, and performing the engineering work involved, does not constitute unlawful practice of engineering.

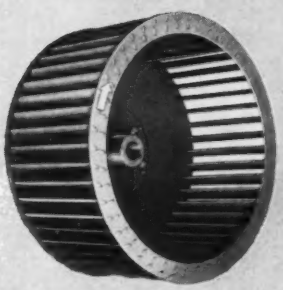
"3. Because of ambiguities in the law and its current interpretation, unregistered individuals signing company documents with assigned titles implying engineering status may risk a charge of unlawful practice of engineering . . .

"4. An employer should avoid involvement in the controversy between engineers who favor registration and engineers who desire to exercise their lawful right to do engineering work without being registered. An employer, particularly a large employer, should not favor the use of 'PE' after signatures on company documents because this is a form of pressure on unregistered engineers. Nevertheless, registration offers to the engineer an opportunity to show loyalty to his profession . . . " — letter from L. Wetherill, manager-Engineering, General Electric, Pittsfield, Massachusetts, as published in *The GEEC Bulletin*. ▲▲

CLARAGE

New line of
V-belt driven
Ready Units





LS Ready Units have Low Speed, forward curved blade wheels. These are of the long-recognized Clarage Type HV multiblade design.

or

MS Ready Units have Medium Speed, backward inclined blade wheels with non-overloading horsepower characteristic. These are of the highly regarded Clarage Type NH, Class I design.

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Distinguishing points — over 15 of them — make these new Clarage units outstanding.
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Clarage Ready Units are ideally suited for supply or exhaust jobs — indoors or outdoors — for buildings of all types, all sizes.

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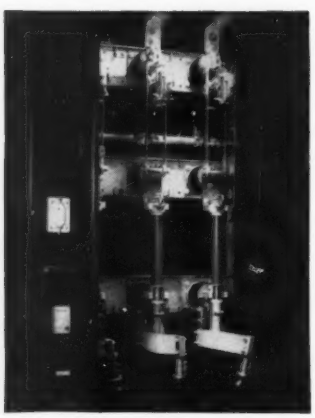
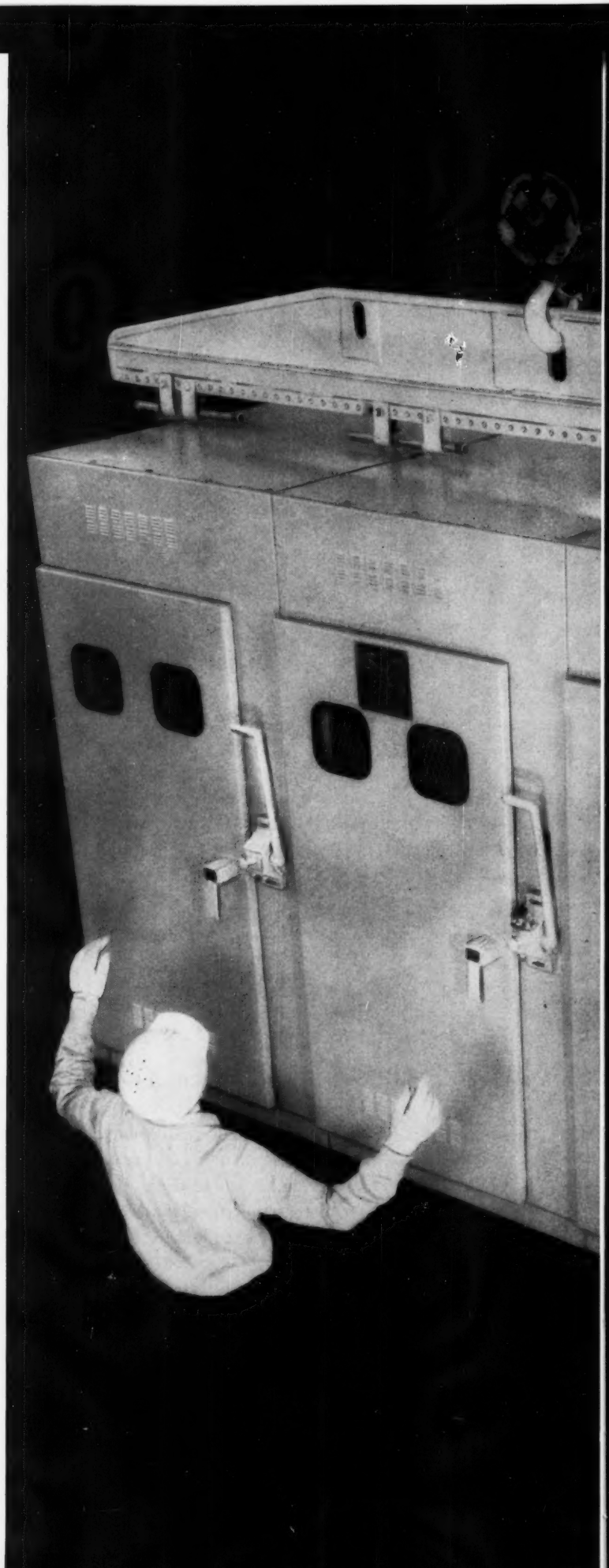
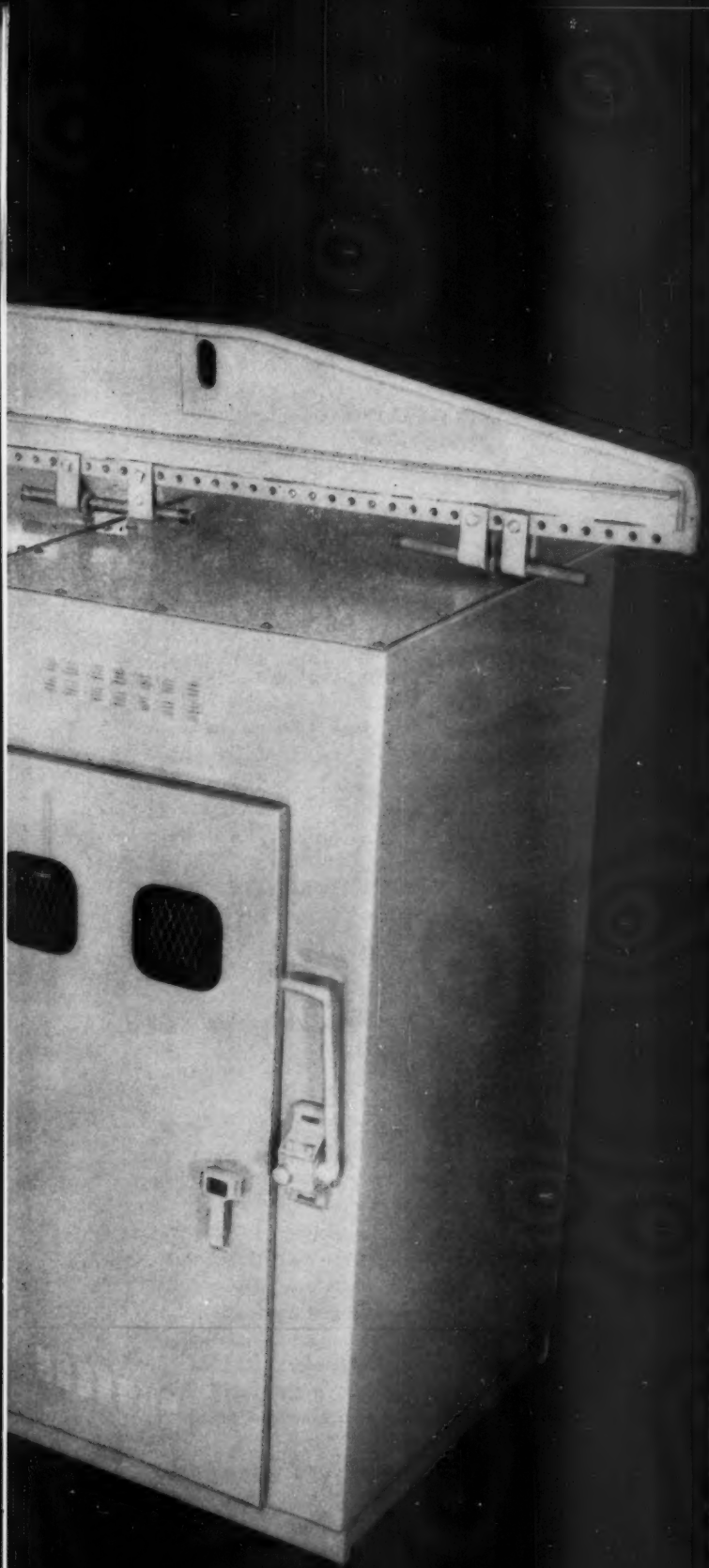


Inside view of typical bay, showing load interrupter (for switching), power fuses, and out-going pothead.





S&C Metalclad Switchgear weighs 60% less — requires 50% less floor space

This S&C Metalclad Switchgear unit, rated 13.8 kv, weighs only 4500 lb., requires only 36 square feet of floor space (excluding aisle space), yet costs only $5,000. Why? Through the simplicity of S&C's design. Power fuses provide fault protection and load interrupters do the switching. Result: the most dependable yet most economical protection possible for high voltage power circuits in industrial and commercial installations. Besides initial low cost here's how else you save:

Low installation costs. Because S&C switchgear is lighter it's easy to uncrate, handle and move into place. Often you can utilize space on roofs or balconies without the expense of reinforcing. The S&C unit shown here weighs only 125 lb. per square foot—60% less than other types of metalclad switchgear.

Less floor space. S&C switchgear is shallower. (The unit shown here is only three feet, eight inches deep.) It can be backed against a wall since rear access is not required. No extra floor space is needed at the front for drawout. So you can cut your floor requirements 50%.

Power fuses give protection against permanent destructive faults. Industrial and commercial high-voltage power circuits are not subject to transient faults and so don't need the automatic reclosing feature of the circuit breaker.

S&C fused interrupter gear meets the new National Electrical Code requirements for fault closing. It is available in short circuit interrupting ratings up to 500 mva at 14.4 kv, 250 mva at 4.16 kv. Continuous current ratings are 200, 400, and 720 amperes. Maximum capacity of main bus, 2000 amperes.

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From the Editor's

Tranquil Tower

Simply Sweet Accord . . .

THE FIRST TWO speakers at the University of Wisconsin's "Institute on Management Problems of Consulting Engineers," (page 80) were Hueston M. Smith, president of Consulting Engineers Council and R. H. Tatlow III, president of the American Institute of Consulting Engineers. Two men more representative of the profession could hardly be found, and the University of Wisconsin is to be congratulated on having brought these two distinguished engineers together to speak before a large and attentive audience of their colleagues in private practice.

This is the first time that the presidents of these organizations have appeared together on the same platform, and it was gratifying to hear them, under questioning from the audience, support each other's positions and back up each other's claims.

The Council and the Institute are both national organizations, each with membership restricted to engineers in private practice. They might be expected to be grasping greedily for each other's members. There might be claims and counterclaims; accusations and recriminations; denunciations and denials. Instead, there is nothing here but sweet accord.

The reason for this is that both the Institute and the Council lately have been directed by men who correctly understand the purposes of their organizations and have found them to be not in conflict but complementary.

There is every reason these two groups should work together, for they are composed of men of much the same professional background, all of whom earn their living through the private practice of engineering. Their beliefs, their goals, and their standards are basically the same. They partake of the same ethos. Both organizations are part of Engineers Joint Council. Both know exactly where they stand on the matter of private practice and public works.

These common interests draw them together, while no excessive ambitions, no avaricious numbers game drives them apart. The Institute aims at great stature, not great size, and the Council supports it in this policy. On the other hand, the Council is much interested in continuing its rapid growth in size, and the Institute is in full accord.

The Institute has grown to be (perhaps was conceived as) a club of distinguished engineers in private practice. While there are a few penny-dreadful exceptions, these men are truly representative of the finest and most successful engineers in private practice in this country. No other organization in the world has on its roster such a high percentage of eminent engineers. Alphabetically the roster starts: Abbett, Robert W.; Ackerman, Adolph J.; Allen, Hershel H.; and Ammann, Othmar H. Its other members, all together numbering less than 300, are mostly men of this same high level of distinction. The Institute may be accurately described as a small group with great professional prestige.

The Council, while including among its membership many men of national stature, does not even suggest that its members are especially celebrated or in any way set apart or above their fellows in private practice. The Council is interested in bringing together all the principals of reputable consulting engineer firms that they may establish standards, settle controversies, dispel misunderstanding, and share knowledge. The Council, therefore, can be more successful as it grows. It can provide mass to support the Institute's tall tower of prestige. Together they can assure a promising future for private practice.

The Institute's Tatlow and the Council's Smith have evinced a rare quality in society presidents — they really want to work together. May they be but the first of a long line of Institute and Council officers who see the worth of combined effort. ▲▲

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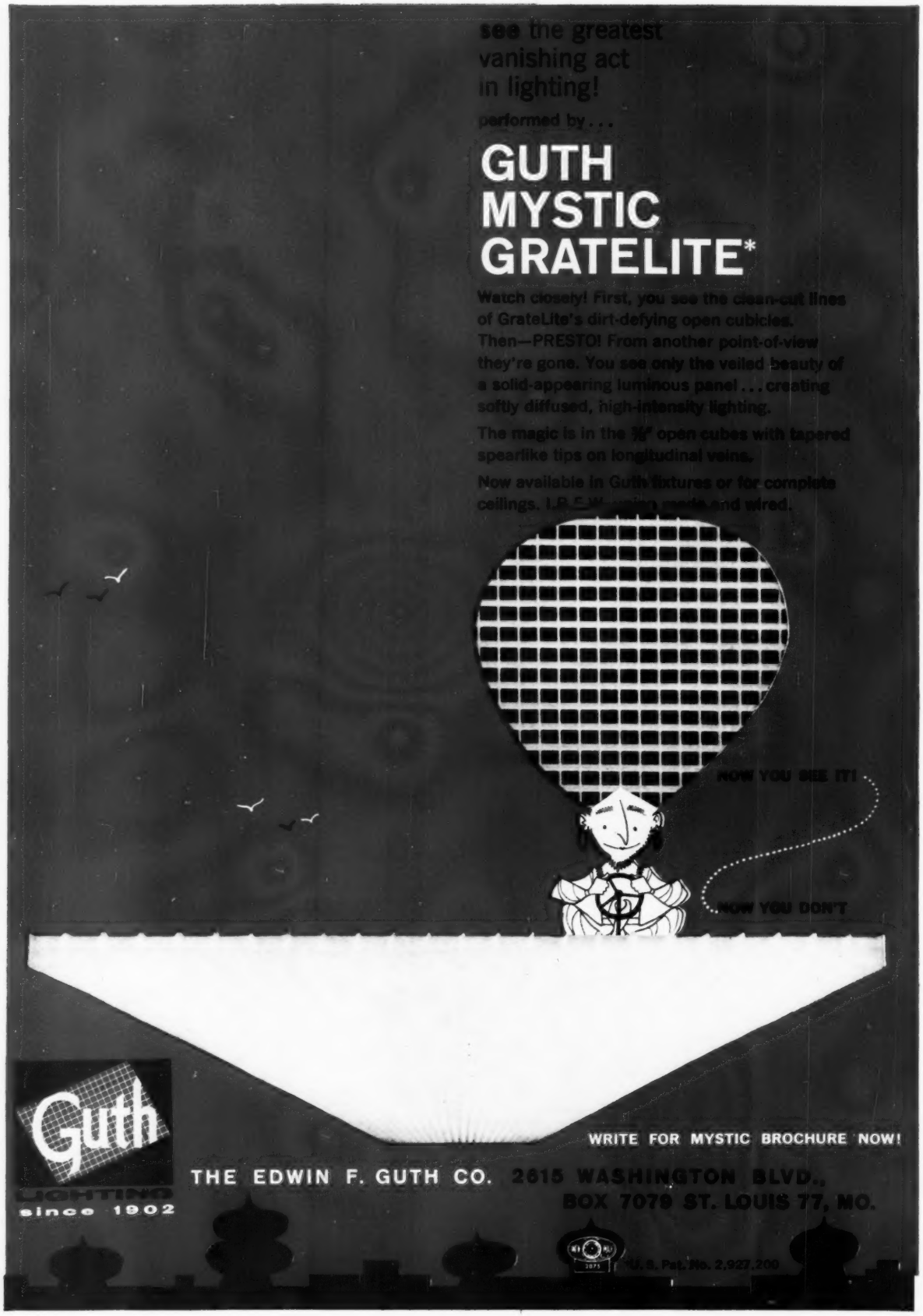
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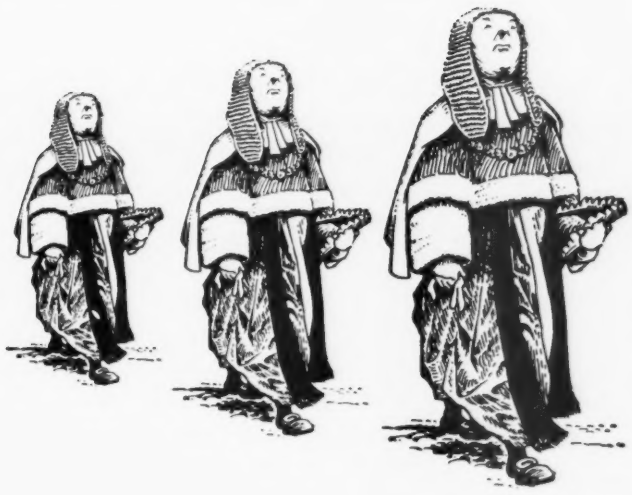


The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

Conditions of the Contract: Insurance and Legal Responsibility

THE "Conditions of the Contract" forms of both the Consulting Engineers Council (CEC) and the International Federation of Consulting Engineers (FIDIC) contain provisions relating to insurance and other matters involving legal responsibility. They are, in general, similar in these respects, but not entirely the same.

Insurance

The CEC form (Sec. 2.5.01) is specific as to the exact minimum amount of insurance of each type which the contractor must carry, e.g. $200,000 public liability insurance, $50,000 property damage insurance, etc. The International form (Sec. 21) is not that specific, but essentially it does serve the same general purpose.

Coupled with the requirement that the contractor carry insurance is a provision in each form as to indemnification. The CEC form (Sec. 2.5.02) provides that the contractor indemnifies the owner from all damage claims for which the contractor is responsible. The International form (Sec. 22) is more complicated, however. While it also provides such indemnification, in general, there are some explicit exceptions, namely:

¶ Damage claims by tenants or occupiers of the land, arising out of damage to the land or to crops on the land.

¶ Damage claims arising out of the permanent use or occupation of the land by the works (e.g. public or private nuisance claims).

¶ Damage claims based on denial of the right of the owner to construct the works on, over, under, in, or through the land (e.g. trespass claims).

¶ Interference with light, air, way, water, or other easements, which is unavoidably the result of the construction.

¶ Damage claims resulting from an act or neglect of the owner or his agents, servants, or other contractors (who are not employed by the contractor).

While these exceptions would presumably all be implied in any event under the CEC form, the important difference is that the International form goes on to provide that in the last four of the above cases, the owner indemnifies the contractor against liability (Sec. 22, item 2). This is especially important in the case of damages caused by other contractors. Here there appears to be a real difference of approach in the two forms.

Failure to Maintain Insurance

If the contractor fails to maintain in force the required insurance, the owner may, under the International form (Sec. 25), do so himself and deduct the amount paid as premiums from the money coming due to the contractor, or else recover it as a debt due from the contractor.

This provision is, however, missing from the CEC form. While it may be thought that it is necessarily implied, there is doubt about this, in view of other explicit provisions in the form. Thus, under the CEC form (Sec. 2.7.05), it is provided that the owner may withhold payment in whole or in part on an approved request for payment to the extent necessary to protect himself from loss on account of any of the following causes: (a) defective work, (b) evidence indicating the probable filing of claims by other parties against the contractor, (c) failure of the contractor to make payments to subcontractors, material suppliers, or labor, or (d) damage to another contractor. It will be noted that the payment of insurance premiums is not included in this list, and by implication is excluded. While it is clear that the contractor will be breaching the contract if he fails to maintain the required insurance, there is no actual loss caused directly by this breach, and it is a matter of speculation wheth-

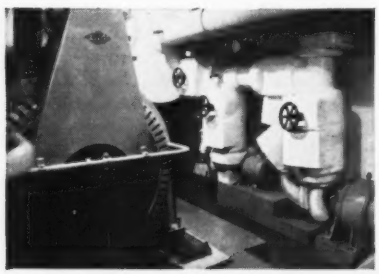
COMPACT POWERFUL

Weinman Unipumps save space, save weight, save costs

The Weinman Unipump in the photo above delivers 250 g.p.m. against a total dynamic head of 85'. Yet, as you can see, overall length doesn't exceed 26¼". Casing, normally cast iron, is also available in special alloys.

Efficient, compact Unipumps are available in capacities from 10 to 1700 g.p.m. Closed back design eliminates need for a second wearing ring or stuffing box water seal. They are probably the easiest-to-install pumps ever designed. You can mount them horizontally, vertically or at an angle and they will give long service at low maintenance cost.

You will want full performance and dimensional information about these versatile pumps. Call your Weinman pump specialist. He's in the Yellow Pages. Or, write us for Bulletin No. 300.



Two 3G25-2 Weinman Unipumps circulate brine in refrigerating plant for Rockefeller Center Skating Rink, New York City.

THE WEINMAN PUMP MFG. CO.
290 SPRUCE STREET COLUMBUS 15, OHIO
CENTRIFUGAL SPECIALISTS

er the owner has the right to solve this problem by "self-help."

Insurance Policy Filing

It should be noted further that the CEC form (Sec. 2.5.01) provides that the contractor must not commence work without filing a certified copy of the insurance policy with the owner, and that the policy must contain a provision to the effect that it cannot be cancelled by the insurance company without 10 days prior notice to the owner. However, the CEC form fails to go on to make an express provision as to what the owner can do if such an eventuality arises.

CEC Form Could Be Improved

The CEC form (Secs. 2.3.14 and 2.3.15) allows the owner to correct deficiencies in the performance of the work – or to terminate the contract and complete the work himself in case of breach by the contractor. However, it fails to provide expressly a remedy other than termination of the contract in case the contractor fails to maintain the required insurance.

It would therefore appear that the CEC form could be improved by the insertion of a provision of the type contained in the International form, in connection with this particular matter.

Delays in Completion

Delays in completion of the work are treated similarly in both forms – for the most part in quite a vague manner.

Delays caused by the owner in not giving possession of the land will in both forms support an extension of the time for completion, as well as an adjustment of the contract price to cover the contractor's additional expense (CEC Sec. 2.3.08; Int. Sec. 42).

Other delays "beyond the contractor's control occasioned by an Act of God, or act or omission on the part of the owner, or by strikes, lockouts, fires, etc., may entitle the contractor to an extension of time

Facts you should have on file under "stokers"...and "savings"

(File this page, send coupon now)

Whether your company will talk new stoker next month or three years from now, your review of stoker performance will not be complete without the facts on AE Vibra-Grate Stokers and the outstanding savings assured with the exclusive Vibra-Grate design.

The AE Vibra-Grate Stoker is the only stoker which combines the maintenance-savings features of water cooling and the high-efficiency features of a vibrating grate and controlled zone undergrate air.

Operating reports from some of the country's most cost-conscious companies now using Vibra-Grate Stokers are nothing short of phenomenal.

For example: A 40,000 lb boiler fired by a Vibra-Grate Stoker at S. C. Johnson & Son (makers of Johnson Wax Products) has never had an unscheduled shutdown since the stoker was installed in October 1954. Coal savings have averaged 919 tons per year. There has been no trouble with clinkers or coking coals. Total repair costs for the first five years, when 34,962 tons of coal were consumed, were only $188. A hair over ½ cent per ton of coal!

For example: At Spaulding Fibre Company, two Vibra-Grate Stokers have saved 2000 tons of coal in two years, compared with other stokers in the same plant. Average evaporation on one unit is 10.6 lb of steam, 10.8 on the other, using coals having an average Btu value of 13,173. The company writes, ". . . efficiency and operating economies far in excess of the manufacturer's guarantee and our highest expectations".

For example: Savings of $300 a day are reported by a major textile manufacturer. In this instance oil fired boilers were replaced by a 70,000 lb/hr Vibra-Grate Stoker. The unit is operating at 80.7% efficiency, even though the boiler has no heat recovery equipment.

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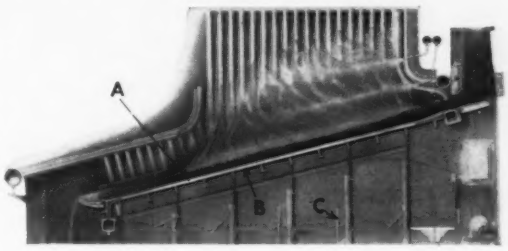

The vibrating grate (A) insures compact distribution of fuel, and elimination of holes and light spots. Thus, the stoker can handle low or high volatile bituminous coal, as well as lignite and semi-anthracites—wet or dry.

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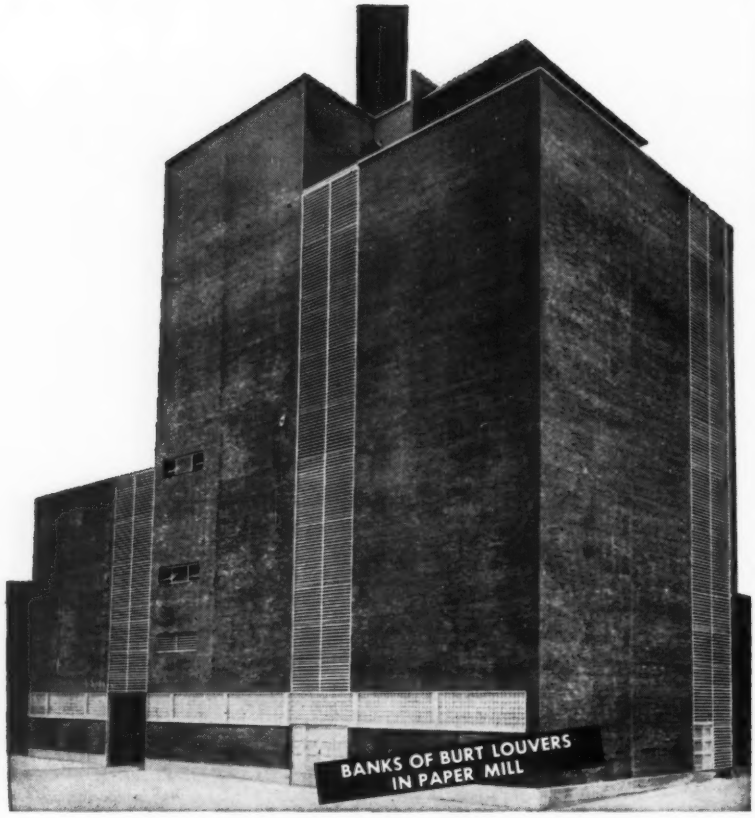

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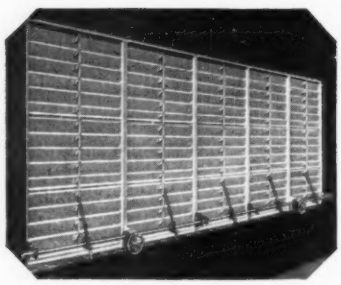

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in which to complete the work as determined by the engineer," under CEC Sec. 2.6.06. An "Act of God" is interpreted in law and is defined in the CEC form to mean a natural disaster, such as an earthquake, hurricane, tornado, or unusual flood. What "etc." means, however, no one can say, — especially when it is "a delay occasioned by etc."

The International form (Sec. 44) is even more indefinite on this subject. It provides that should "special circumstances of any kind whatsoever which may occur be such as fairly to entitle the contractor to an extension of time for the completion of the work the engineer shall determine the amount of such extension." How he will know whether or not the contractor is "entitled" to an extension is not disclosed. It is sufficient, evidently, to caution the engineer to be "fair" about it.

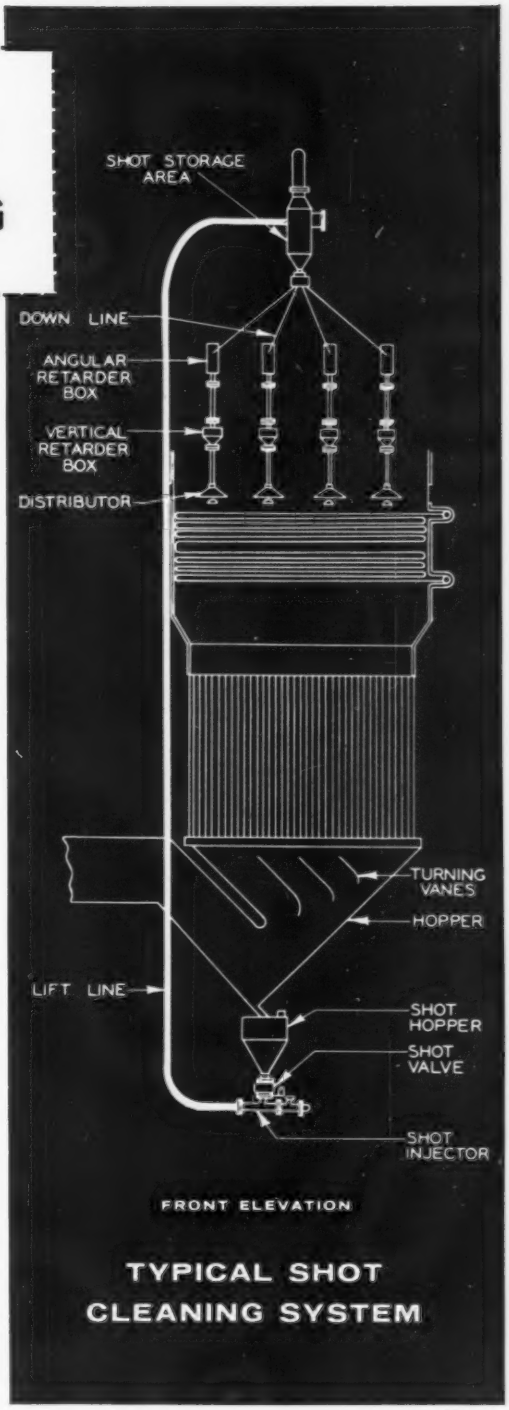
Liquidated Damages

The CEC form contains no provision as to liquidated damages in the event of late completion of the work by the contractor.

The International form, on the other hand, refers (Sec. 47) to the provision of liquidated damages in the tender (or proposal, as we would call it). A blank space is left in the latter document, for filling in the amount of liquidated damages per day, if desired. The "Conditions of Contract" points out that the provision for liquidated damages is not intended as a penalty, that the owner may recover this amount from any money in his hands due or which may become due to the contractor, and that the payment or deduction of such damages does not relieve the contractor of his obligations and liabilities under the contract. These are all very desirable provisions, from a legal point of view.

Provision is also made in the International form for the payment of a bonus for early completion, if this is desired. ▲▲

DIAMOND
SHOT CLEANING



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This system offers much improved cleaning of certain areas of boilers such as tubular air heaters, horizontal superheaters, economizers, and reheaters. It will often accomplish effective cleaning where this has not been possible previously. Areas which tend to foul rapidly may be kept completely clean by increasing the length of the automatic shot cycle (it may be continuous if necessary) without disturbing boiler operation. No platforms or galleries are needed as with conventional cleaning equipment so aisle space often may be reduced.

Uniformly low draft loss and constant flue gas temperature are easily maintained because deposits are removed before they impair the thermal efficiency of the plant.

Cleaning is accomplished by thousands of steel shot that cascade over tube surfaces and ricochet from tube to tube, or through the insides of air heater tubes.

How It Works

Falling shot, spread uniformly by distributors scours the fouled area. Deposits are removed in small particles, most of which are carried away by the gas stream. Heavier particles fall into the shot hopper and recirculate with the shot until broken fine enough to pass out with the gases. Cleaning is thorough even with difficult fouling such as is found in black liquor fired boilers. The same quantity of shot will clean the entire vertical section with no limitations in height.

Operation is automatic. Shot is lifted pneumatically from the hopper to a shot storage area where it falls by gravity through retarder boxes to the distributors. Length and frequency of cleaning cycle are chosen according to the fouling rate of the area and the type of deposit.

More than 30 Diamond Shot Cleaning Systems are now in successful operation in the United States . . . some of them since 1954. This is the result of Diamond's extensive research in shot cleaning over a period of years. In Europe shot cleaning has been in use over ten years and there are more than 800 installations in highly satisfactory operation. To supplement our developments, Diamond has acquired U.S. rights to the Broman-Ekstrom System used in Europe.

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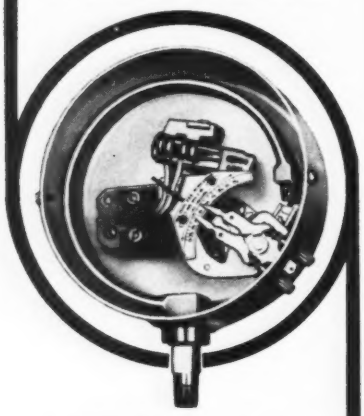

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Wisconsin's Institute for Consultants To Become Annual Event

Over 50 heads of consulting engineer firms from 13 states and Canada spent two days at the University of Wisconsin's Engineering Institute dealing with management problems of consulting engineers. The conferences were held in Madison, Wisconsin, June 2-3. The morning session featured three talks, the first on "Organization and Management of an Engineering Firm," by Hueston M. Smith, president of Smith-Hanlon-Zurheide-Levy, Inc., of St. Louis, and president of Consulting Engineers Council. The second was on "Financial Aspects of Operating a Consulting Engineering Firm," by R. H. Tatlow III, president of Abbott, Merkt and Company, of New York, and president of the American Institute of Consulting Engineers. These two distinguished association presidents were followed by Art V. Maxwell of Nielson, Reeve & Maxwell, Ogden, Utah, who talked on "Engineering Contract Documents." All three speakers made excellent presentations, and Tatlow's paper was outstanding in being accompanied by a number of slides showing actual financial and scheduling forms used by his engineering firm in its financial operations and its dealings with clients and contractors.

After lunch the conferees were divided into three sections, each in its own room, and each morning speaker then spent one-third of his time in each room discussing details of his assigned topic. This permitted full audience participation throughout the afternoon session. The split groups then were brought back together, the speakers put on the platform, and general questions were asked following a summation of the discussions in each separate section. This provided an opportunity for everyone attending the conference to deal directly with each speaker and discuss fully any points of interest.

That evening following a dinner, Hunter Hughes, editor of Consulting Engineer magazine, presented a number of slides and a discussion dealing with the rebuilding of Paris under Napoleon III.

The next day the morning and afternoon sessions were handled in the same manner as before, with three different topics. The second day topics dealt with external relations of consulting engineers, the first paper being a discussion of "The Consulting Engineers Recommended Manual of Practices," with Hueston Smith again speaking — this time as a substitute for a speaker who found at the last moment that he could not be present. This was followed by "Architect-Engineer Relationships," by Henry A. Naylor, Jr., of Whitman-Requardt & Associates, Baltimore, and finally by "Techniques of Joint Ventures," by David L. Narver, Jr., Holmes & Narver, Inc., Los Angeles, and "Ethics — Real vs Theoretical," as interpreted by Joe Williamson, Williamson and Associates, St. Louis.

The University of Wisconsin staff in charge of this conference stated that it was by far the best of the three conferences on consulting engineering that have been held by the University. It is proposed that these same Institutes be repeated each year with new and timely subjects and speakers of national renown. Consulting engineers attending the sessions were enthusiastic about the program, and every indication is that this Institute can be expected to establish itself as an annual series of conferences for consulting engineers. ▲▲

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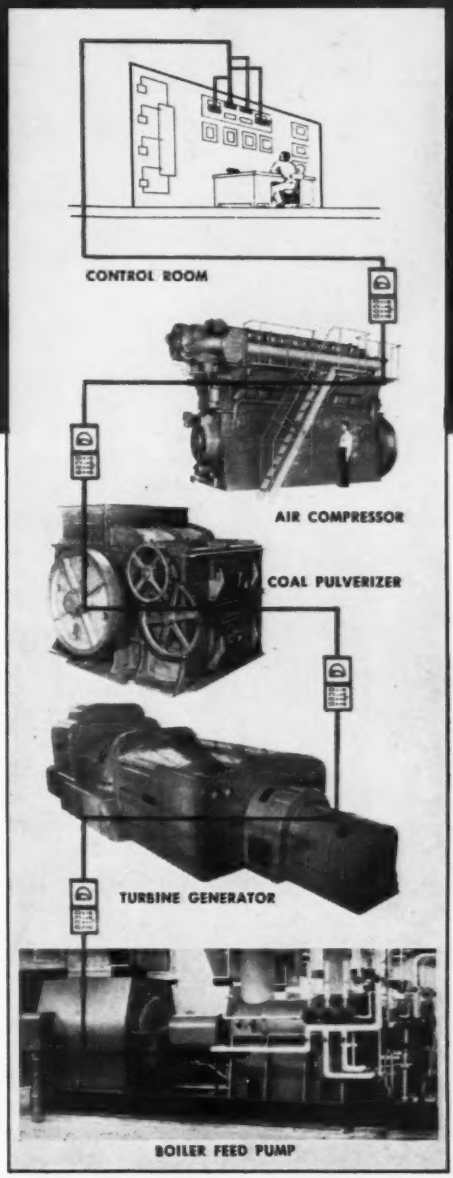

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Presenting . . .

saves weight and cuts costs

The use of high strength steel as a means of saving weight and reducing costs in bridges is rapidly gaining favor. These twin bridges across Six Mile Creek on the Erie Thruway, 15 miles east of Erie, Pennsylvania, were built with 600 tons of USS MAN-TEN Brand High Strength Steel to ASTM specification A-440 and 1,200 tons of ASTM A-7 Steel.

High strength steel was used for heavily stressed members where its higher allowable stress value and weight savings made it more economical. The design stress in bridges for USS MAN-TEN Steel is usually 24,000 psi compared to 18,000 psi for ASTM A-7 Steel. The members shown in color in the diagram were made of USS MAN-TEN High Strength Steel. In addition, many of the gusset plates were MAN-TEN Steel.

Weight savings: USS MAN-TEN (A-440) Steel fully meets all the requirements of the new ASTM specification A-440. When full advantage of its higher yield point—50% greater than structural carbon steel—is utilized, it allows the engineer to design with smaller sections than would be normally used—and thereby realize weight savings up to 25%. A cost savings is also possible, since anywhere USS MAN-TEN Steel accomplishes a weight reduction over 16%, it then becomes the more economical steel to use.

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USS Steels for Bridge Design

Structural Carbon Steel 33,000 psi minimum yield point	**USS MAN-TEN High Strength Steel** 50,000 psi minimum yield point
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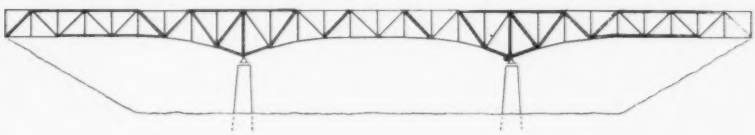

Where high strength steel saved money. Profile of one of the two bridges showing members made of USS MAN-TEN Steel where its high strength/weight ratio made it economical to use.

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Presenting . . .

Our Authors

Morris V. Gelders and **Louis S. Booth** of Lockwood Greene are southern born and bred – hence well qualified to discourse on the subject of air conditioning the nation's colleges (page 96). Gelders is an electrical graduate of the Georgia Institute of Technology, who did design work on air conditioning and electrical systems at the Panama Canal before entering the Army Air Corps. Discharged as a captain in 1946, he joined Lockwood Greene, and has been with the firm ever since. Booth is a graduate in architecture from MIT, with prior work at the University of Richmond. He too joined Lockwood Greene in 1946 upon discharge from the Army. He is presently a member of the firm's board of directors and head of the department of architecture in Spartanburg.

Giorgio Pellegrini, writing on Italy's Highway to the Sun (page 89), has a doctorate in civil engineering from the University of Rome. He spent some time in private practice before attending Purdue University on a fellowship from the International Road Federation. More recently, he has been a research associate and lecturer in civil engineering at the Technological Institute of Northwestern University. Currently, he is enroute to Rome, honeymooning with the bride he met and courted during his stay at Northwestern.

Herbert F. Shatzman is no newcomer to the pages of CONSULTING ENGINEER. He is in charge of the estimating and specifications department of Seelye Stevenson Value and Knecht, and in the past six years has estimated over $200 million in construction projects. His background as a structural designer and field inspector and supervisor give him a good grasp of the subject of comparative cost estimates (page 128). Shatzman is a graduate of the College of the City of New York and a professional engineer in New York State.

Warner Howe is another engineer with experience at the Panama Canal, this time in the structural field. A graduate in civil engineering from Cornell, he is presently a partner in the Memphis firm of Gardner & Howe. He is concerned with the problems of consulting engineers in the field of reinforced concrete design (page 86) – particularly with the need for adequate fees. Howe has had extensive experience with the U. S. engineers and the U. S. Navy, is registered in four states and with the National Bureau.

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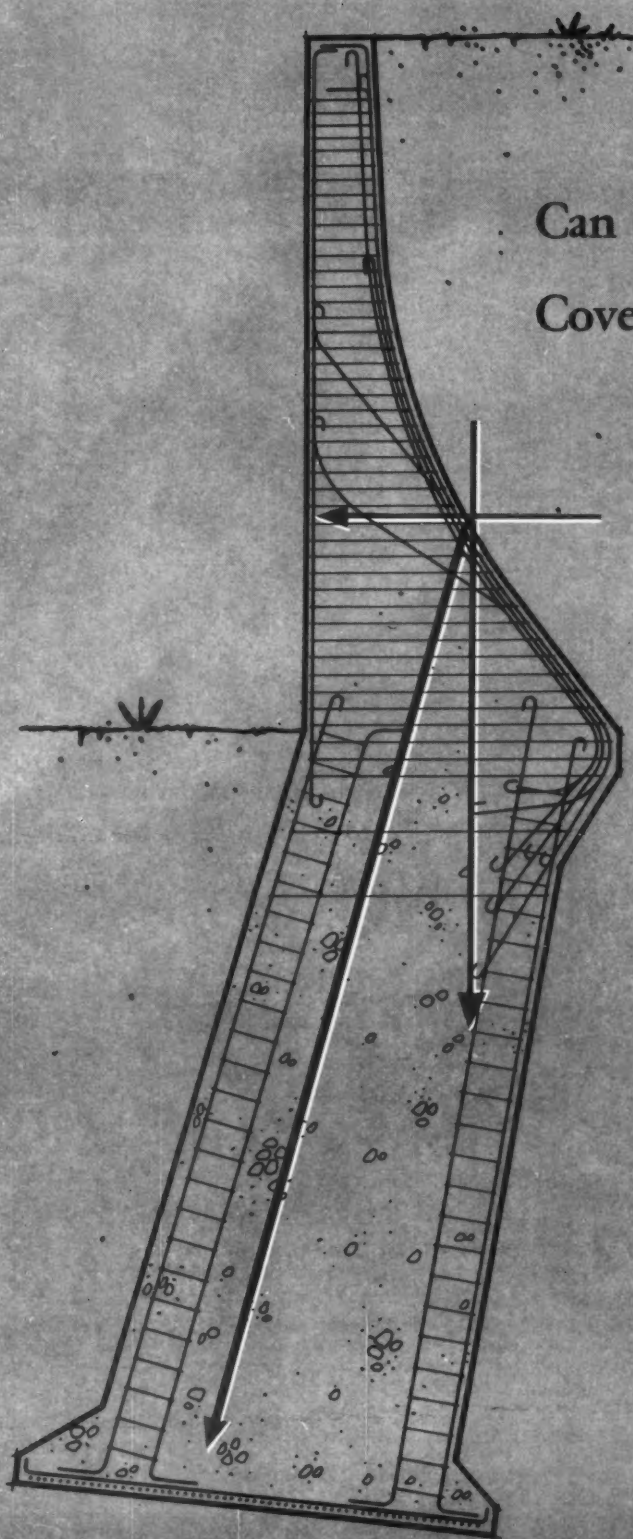


Can the Construction Contract Cover Detail Engineering Costs?

WARNER HOWE, Principal
Gardner & Howe, Structural Engineers

CE exclusive

MANY FACTORS have a bearing on the ultimate quality of reinforced concrete structures. Together, they make heavy demands on the time of the consulting engineer in both design and supervision of construction. The design of reinforced concrete is particularly complicated because of the unlimited styles of construction, the wide latitude in sizes and shapes of members, and the rapid development of new construction techniques. The construction is also complex because concrete is mixed on the job site or in a concrete plant and delivered to the site by labor with varying degrees of skill, under changing conditions, and in all types of weather. The forms in which the concrete is cast must be designed, detailed, and built by persons of varying proficiency. And the reinforcement is fabricated and placed by workmen usually unfamiliar with the design requirements. Then the cast concrete must be properly protected and cured.

Standard procedures cannot be established for detailing reinforced concrete, as they are for structural steel and other materials which are manufactured and fabricated in highly specialized plants under closely controlled conditions. Concrete inspected after completion cannot by its exterior appearance give any assurance that all of the varying factors affecting its ultimate quality have been adequately cared for. It therefore is mandatory that reinforced concrete construction be given special attention with regard to fabrication details and,

particularly, supervision during construction to insure a safe and adequate structure.

Failures Point to Need for Supervision

A study of some recent structural failures – many in reinforced concrete design – indicates that inadequate shop details and insufficient engineering supervision during construction were primary causes. Most of these failures would have been prevented if the designing engineer, the one most familiar with the structural requirements, had followed through in the supervision and details of construction. The structural consultant realizes that he has not discharged his full responsibility when he has completed the design, because attention to the details of construction is as important to the safety of the structure as is the design.

The trend in recent legal decisions holds the architect-engineer design team more and more responsible for its negligent errors or omissions. The professional specialist also is being held responsible for exercising a reasonable degree of skill and ability in his field. Recent California and Louisiana decisions establish the legal responsibility of the architect – and therefore the engineer – to supervise without negligence all construction under his direction. The courts have ruled that authority to exercise control over the contractor carries commensurate legal responsibility even though no contractual agreement exists between the two parties. The engineer designer has a legal responsibility to adequately supervise construction even though there is no specific contract for these services.

Adequate Compensation Not Easily Obtained

It is obvious therefore that there is more and more engineering cost and responsibility involved in the design and construction of reinforced concrete structures – often with little chance for adequate compensation through increased fees. It behooves the reinforced concrete construction industry, and particularly the structural consultant, to find an ethical and equitable way to compensate the consultant for design, detail, and supervision of reinforced concrete construction.

The usual procedure is for the architect, who has been commissioned by the owner at a recognized standard architect's fee, to contact a structural engineer and to request a proposed fee for his services. The structural consultant is faced with two alternatives. He can quote the usually accepted standard fee which would provide a reasonable profit for a normal structural steel design and its inspection during construction. Or, he can ask an appropriately higher fee required to prepare the reinforced concrete design and to provide the detailed supervision necessary during construction.

If the consultant chooses to quote a standard fee, he probably will try to promote a steel structure. However, if he must design a reinforced concrete structure, he will be tempted to design more approximately and therefore conservatively, or provide less than the desired inspection. Then he, the owner, and the concrete construction industry may suffer.

If he elects to ask for an appropriately higher fee, undoubtedly he will experience considerable resistance from the architect and even more from the owner – and run the risk of driving the architect to another engineer. But despite the risk, this obviously is the better procedure. Often it can be sold, if the owner is made to understand that these services are an inherent and necessary part of reinforced concrete construction and really do not add to the over-all cost.

However, there is another approach that has considerable merit. Under it, the structural consultant furnishes the reinforced concrete shop drawings and detailed special supervision as a part of the contractor's construction cost. This method has been employed successfully by structural engineers in the Memphis area for over 50 years.

In all types of construction, shop drawings and supervision of construction traditionally have been the contractor's responsibility. For uniformity, these services logically should continue to be a construction cost. Shop drawings and detailed special supervision of construction furnished by the structural engineer are services peculiar to reinforced concrete construction. They are not contemplated in the recognized design fee schedules and, in fact, demand far more than the normal design and inspection services anticipated in these schedules. Their cost traditionally has been paid for through an allowance in the construction contract as provided in the project specifications.

Shop Drawings By Consultant?

The structural engineer bears many responsibilities to all parties involved in the construction of a building. The registered professional engineer first has a responsibility, as provided in the registration laws, to protect public health and safety. His responsibilities to the owner, client, or architect to design and inspect construction are clearly defined in standard contract agreement forms recommended by AIA, NSPE, and ASCE. After a construction is let, the engineer also has a legal and ethical responsibility to the contractor. This includes seeing that the contractor gets a fair interpretation of the contract documents, helping the contractor execute the contract through knowledge of the structural requirements, and providing accurate and timely information pertinent to this part of the construc-

tion. The furnishing of shop drawings and special supervision is compatible with this responsibility.

All codes of ethics stipulate that the engineer should have no financial interest in the contractor or his material suppliers. The payment of an allowance to the engineer, as required in the project specifications and over which the contractor has no control, does not constitute a compromising financial interest on the part of the engineer. It is now customary to specify a construction allowance to cover the services of an independent testing laboratory selected by the architect or engineer. On a construction project the engineer and the testing laboratory have the same ethical and professional relationships to the owner, architect, and contractor. In both instances the use of an allowance in the construction contract is a means of expediting payment without burdening the owner with numerous extra costs for services outside those provided in the general construction contract and the architect-owner agreement. Where the owner and contractor are properly appraised though appropriate provisions in the project specifications and the architect properly supervises these services, there should be no question of improper practice.

A Professional Must Be Assumed Ethical

Any professional in his normal course of business is faced with many temptations which he must turn aside. The mark of a true professional is measured by how well he stands up under these situations — by his professional integrity. We must assume that a registered engineer will not succumb to unethical practice. To assume otherwise we would have to change our whole concept of the professional status of the engineer. It is an accepted fact that most professional engineers have unusually high standards of conduct. Thus, the furnishing of shop drawings and special supervision paid for through a construction allowance presents few additional temptations to which the engineer is not already exposed — and none which he cannot overcome easily. If the owner has selected an architect-engineer team known for its integrity, he need have no fear of misuse of this service.

A positive approach to professionalism, based on faith in integrity rather than fear of deception, is as essential to engineering and architecture as it is to medicine. Of course we know there are those who take advantage of any opportunity to cheat, but the professional societies, in cooperation with the State Boards of Engineering Examiners, are attempting to exclude these unethical practitioners. Nevertheless, it is important to adopt and promote improved procedures which can benefit the construction industry despite the fact that a few might take advantage of the situation.

Therefore, from a logical, legal, and ethical standpoint, shop drawings and special supervision services provided by the structural engineer as a construction expense are proper. There are other compelling reasons, however, why the structural engineers and the reinforced concrete construction industry should consider this method, for it has distinct advantages to all parties involved in reinforced concrete construction.

Everyone Benefits

¶ The general public benefits through increased safety and better structures as the result of more thoroughly detailed and adequately supervised construction.

¶ The owner benefits since he may consider reinforced concrete construction, which on many projects is more economical and better suited for his purposes, without fear of having inadequate details and supervision of construction. He is assured of a better constructed and safer building at little or no additional cost.

¶ The contractor benefits since he receives more complete construction plans and details, resulting in less cost of formwork and reinforcing placement; and better job coordination, resulting in less errors, elimination of costly corrections, and savings in construction time. Through these benefits and saving of the usual indirect fabricator's detailing fee, the contractor finds that there is little or no additional over-all cost, even though he must pay for these services directly. Although he is not relieved legally of any of his normal responsibility for the proper construction and safety of the building, he has much more confidence when the structural engineer makes the shop drawings and closely supervises the construction.

¶ The architect benefits because he can consider reinforced concrete structures at the recognized fees without penalty. He also knows that the construction will be properly detailed and supervised by the structural consultant, insuring proper coordination of details and safety of the structure.

¶ The structural engineer benefits because he gets more work on a given job. This helps to stabilize his office work load and reduces his relative overhead costs. His engineering personnel get to follow through during the construction phase giving them a much better understanding of building construction. This makes them more practical designers. Thus, the engineer can best discharge his complete responsibility to all concerned and receive compensation for his efforts.

¶ The reinforced concrete construction industry benefits because of the increased incentive to design, detail, and adequately supervise more and better concrete structures. ▲▲

Italy's Highway to the Sun

GIORGIO PELLEGRINI

University of Rome

IN MAY 1955 the Italian Parliament enacted legislation which was to have a marked influence on the Italian road system. The law outlined a new network of toll expressways to link the major cities of the nation and the major border crossings. Construction of these highways was to be financed by private capital, with the national government providing up to 40 percent of the total cost. For this purpose the law contains authorization for an expenditure of $16 million for each of the fiscal years from 1955-56 to 1964-65. Twenty-five percent of the government's contribution must be spent for construction of tollroads in southern Italy. The same law also provided authorization of $3.2 million to be spent by ANAS*, in addition to its normal budget, for the construction and improvement of roads in those regions of southern Italy where the construction of tollroads is not feasible[1].

Among several tollroads for which construction has been initiated, the Highway to the Sun is certainly the most impressive. It links Milan with Naples, through Bologna, Florence, and Rome, with 457.2 miles of four-lane divided roadway, interrupted only at the highway which constitutes the outer ring of the city of Rome. Upon completion of the work, the Highway to the Sun will provide a route 55.6 miles shorter than the existing one.

*ANAS (Azienda Nazionale Autonoma Strade Statali) is an independent agency with its own budget, submitted for the approval of the Parliament as an appendix to the budget of the Ministry of Public Works. The Chairman of ANAS is the Minister of Public Roads, and the agency is responsible for the administration, construction, improvement, and maintenance of the national highway system.

Of the 334.9 miles from Milan to Rome, the first 128.7 miles, from Milan to just beyond Bologna, are already in operation. The section from Bologna to Florence, which is very costly on account of the mountainous terrain, is almost completed. From Florence to Rome portions of the location are yet to be approved by the Minister of Public Works, though sections near these terminals are already under contract. Of the 122.2 miles from Rome to Naples, 27.8 miles from Naples to Capua are already in operation. The remaining section, Capua to Rome, is now under construction.

Geometric Characteristics and Costs

The cross section has been established for the entire length of the tollroad as two roadways 24.5-ft wide, separated by a 10-ft median, with adjacent 10-ft paved shoulders. Criteria for the geometric design of the facility are given in Table 1. Some of the standards for the horizontal and vertical alignment and the standards for the cross section may appear inconsistent with the high value of the design speed. However, in this matter, the differences which currently exist between the characteristics of American and European traffic must be fully recognized.[2]

The agency responsible for building and administration of the tollroad is the Societa Concessioni e Costruzioni Autostrade p.A. This agency is staffed by engineers of high professional competence, but limitations imposed by the design and construction contracts restrict major modification of adopted standards. Nevertheless, the agency is constantly attempting to introduce improved design criteria

TABLE 1 — CRITERIA FOR THE GEOMETRIC DESIGN OF THE HIGHWAY TO THE SUN

Element	Type of Terrain: Flat (Milan to Bologna) (Capua to Naples)	Rolling (Florence to Rome) (Rome to Capua)	Mountainous (Bologna to Florence)
Design speed (mph)	100	80	60
Minimum radius for horizontal curves (ft)	2,300	1,300	820
Minimum radius for vertical curves* (ft)			
— crest	49,200	26,300	16,400
— sag	23,000	16,400	9,900
Maximum grade (%)	3	3.5	3.75
Minimum sight distance (ft)	990	650	590

*Vertical curve design in Italy is based on circular, rather than parabolic, curves. As an example, a vertical curve of 49,200-ft radius at a crest of a +3% grade with a −3% grade requires a length of curve of 2550-ft.

and considerable money is spent on specific research dealing with both highway design and traffic control problems.

The total cost of the Highway to the Sun was initially estimated to be $300 million, but present estimates show that the total cost probably will be close to $380 million upon completion of the facility. The following is the estimate of the amount of work for the entire 457.2 miles.

Cuts	52,000,000 cubic yards
Fills	39,000,000 cubic yards
Viaducts and Major Bridges	304
Minor Bridges	3800
Tunnels	63
Pavement	18,000,000 square yards
Toll Plazas	58
Man Days of Labor	26,000,000

Financing

Based on the initial estimate of $300 million, the State will lend $108 million during the 10-year construction period. After 30 years of operation, as established in the contract, the whole facility and all the activities of the agency will be transferred to the State. The agency building the Highway to the Sun is not exempt from taxation and by that time about $240 million will have been paid back to the State. The only stockholder of the company building this highway is the IRI (Istituto Ricostruzione Industriale), a company controlled by the State.

The toll schedule has been fixed as shown in Table 2. Of the money collected through tolls, about 60 percent will be used to pay interest and service debt (except the loan of the State), 23 percent will be paid to the State, and 17 percent will be devoted to maintenance and administration. Table 3 contains traffic data compiled for the month of April 1960.

The Structures

A total of 304 major bridges and 3800 minor bridges will have been built before the tollroad is finished. Each of the major bridges presents its own problems that are given unique solutions. Among the major bridges, the one over the River Po is the most important structure on the Highway to the Sun. Consideration of the hydraulic and foundation conditions as well as the aesthetic and economic problems, led to the adoption of prestressed concrete construction.

The Po River bridge is 3858-ft long and is divided into 16 spans, 14 of which are 246-ft long, with the two end ones 207-ft long. The foundations are of the hollow-caisson type. Spans are simply supported and consist of four flanged beams which are cast in place with the slab. Each beam is 137-in. deep, has a web thickness of 16-in., and

TABLE 2 — EXAMPLE OF TOLL SCHEDULE

Type of Vehicle	Toll (cents per mile): Flat Terrain	Rolling Terrain	Mountainous Terrain
Average Italian Car	1.3	1.5	1.9
Average American Car (maximum for passenger car)	2.3	2.7	3.5
Single Unit Truck	3.5	4.2	6.5

Photo courtesy of Societa Concessioni e Costruzioni Autostrade p.A.

Construction nearing completion on the Viaduct Flumicello. The Casarsa Tunnels appear in the background.

Photo courtesy of Societa Concessioni e Costruzioni Autostrade p.A.

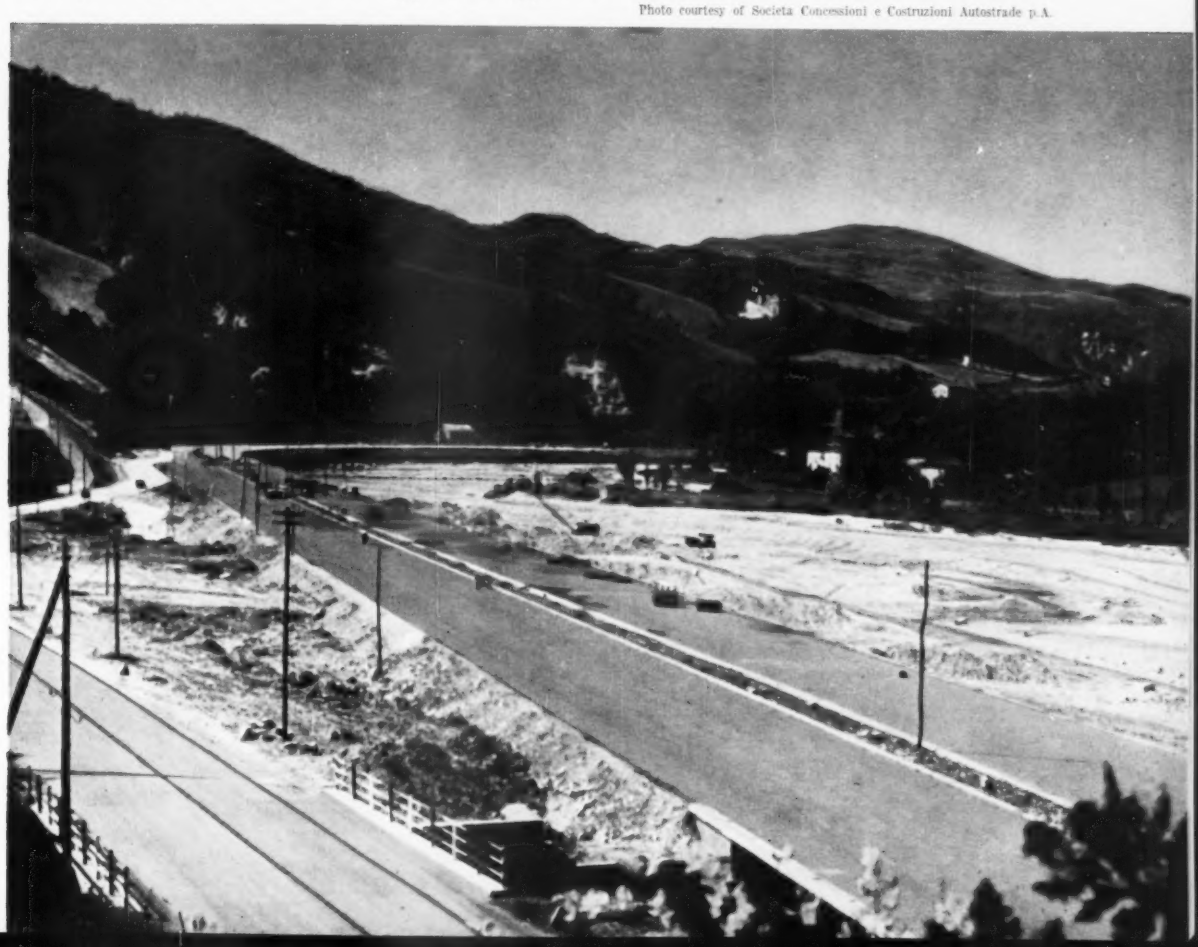
Viaduct over the River Aglio has a theoretical arch span of 537 feet and a total length of 1441 feet.

Photo courtesy of Societa Concessioni e Costruzioni Autostrade p.A.

The interchange at Sasso Marconi. Trumpet design is typical of interchanges on the Highway to the Sun.

View of the Highway to the Sun as it approaches Appennini Mountains, between Sasso Marconi and Vado.

Photo courtesy of Societa Concessioni e Costruzioni Autostrade p.A.



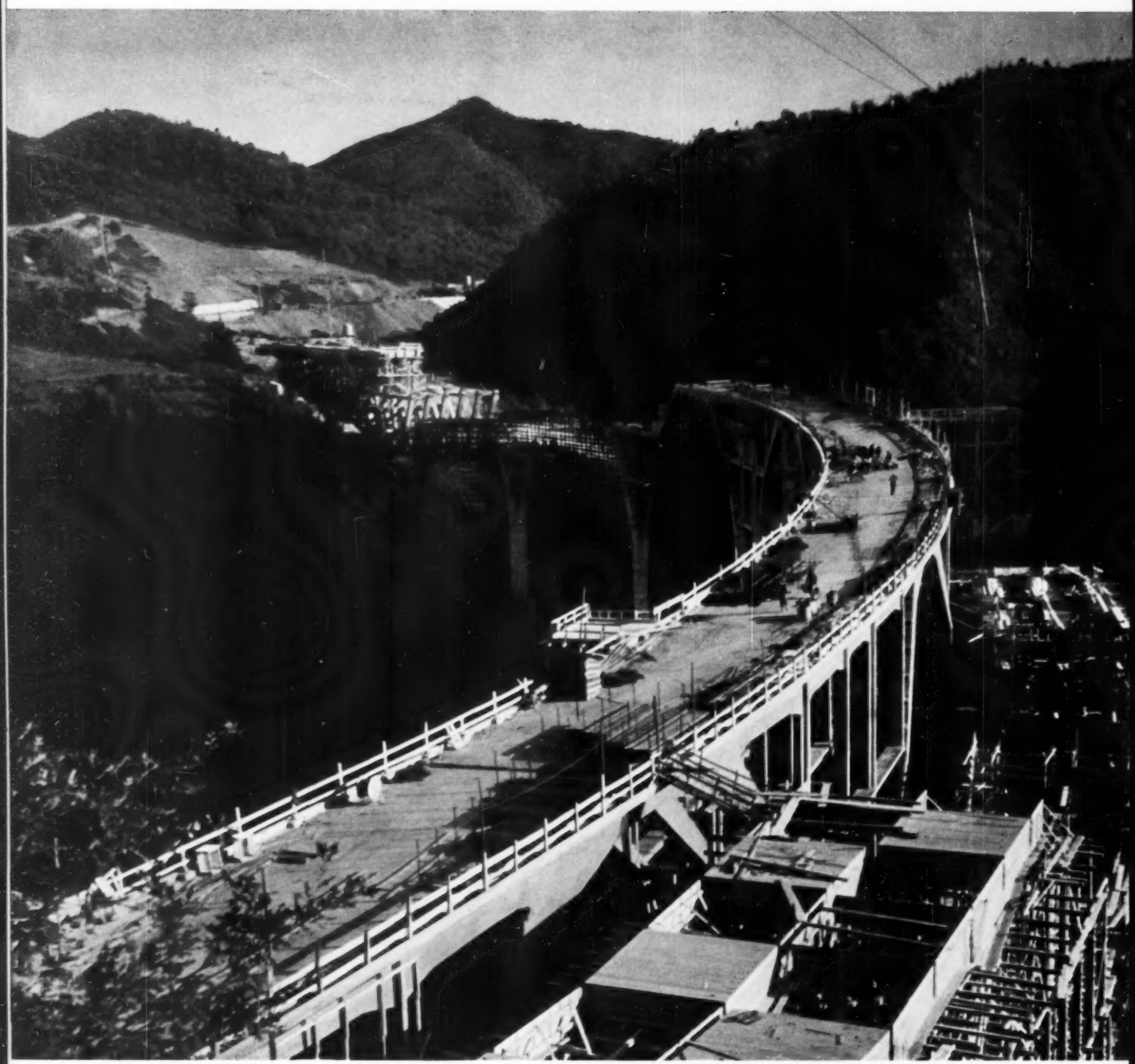


Photo courtesy of Societa Concessioni e Costruzioni Autostrade p.A.

The Viaduct Poggettoue with one lane nearing completion. Total length of the structure is 1503 feet.

TABLE 3 — SUMMARY OF TRAFFIC STATISTICS FOR THE MONTH OF APRIL, 1960

Section of the Toll Road	Average Daily Number of Vehicles Entering the Toll Road			Total Vehicle-Miles for the Month
	Passenger Cars	Trucks	Total	
Milan-Bologna (121.4 miles)	9,638	921	10,559	18,824,011
Bologna-Sasso Marconi (7.3 miles)	766	54	820	180,620
Capua-Naples (27.8 miles)	4,905	691	5,596	2,537,755

a lower flange of 39 inches. The slab is 12-in. deep. Every beam is prestressed by post-tensioning of 24 cables, each consisting of 42 wires of 6-mm diameter. Twelve of the cables are anchored at the ends of the beam, and the other 12, those with more pronounced curvature, are anchored at different points on the surface of the slab. The anchorages are constructed in such a manner as to permit later restressing of the cables.

Prestressing of the beams is scheduled as follows:
¶ Eight of the end cables are pulled with a force of 20 tons each, four days after placing the concrete.
¶ Fourteen days after the casting, the same eight cables are pulled with a force of 105 tons each, and the remaining 16 cables are pulled with a force of 85 tons each.
¶ Twenty-eight days after the casting of concrete, all cables are pulled with a force of 135 tons each.
¶ One hundred days after the casting of concrete, all the cables are restressed to the final value of 135 tons each and grouted.
The bridge is designed so the maximum compressive working stress in the concrete is 2060 psi. The maximum working stress in the steel is 128,000 psi.

Another interesting bridge, also of prestressed concrete construction, is that over the River Taro. It has 16 spans of 110 feet each. The foundations are on Franki piles, 40-ft to 50-ft long. Each roadway is supported on six beams of 55-in. depth. Prestressing of each beam is achieved with five cables of 42, 6-mm wires. In the crossing of the Appennini the tollroad is often in tunnels or on viaducts. Some of the most interesting are shown in the accompanying colored photos.

The Pavement

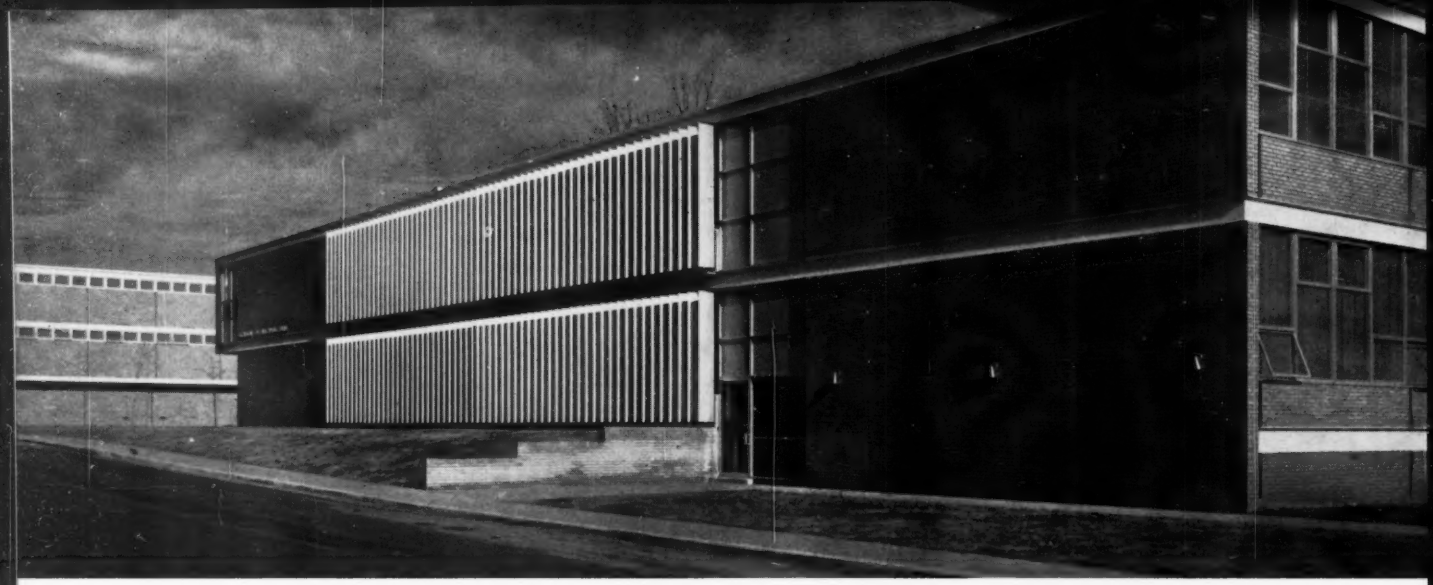
The entire length of the Highway to the Sun is planned with a flexible pavement. The characteristics of the pavement for the section from Milan to Bologna are typical of the construction adopted. The subgrade on this section of the tollroad, entirely in the valley of the Po River, is constituted mostly of soils of the classes A6 and A7 of the AASHO classification. These soils have a low value of CBR, but never less than 4. The depth of frost penetration in the Po River valley is generally between 8- and 11-in. Over this subgrade the pavement is built with a first course of pit-run sandy-gravel which is compacted in two or three layers to a depth of 7½-in. to 10-in., depending on the subgrade. A 9-in. course of soil-aggregate is then placed on the first course, and compacted in two layers. A 6-in. base course provides immediate support for a hot-mix, hot-laid, bituminous concrete pavement. The pavement is placed in two layers, a 1¾-in. binder and a 1¼-in. surface course.

The base course may be constructed in either of two ways. One type of construction utilizes a two-layer macadam, the first layer being water-bound and 4-in. thick, and the second layer being a penetration macadam 2-in. thick. The alternate type of construction is a single layer of asphalt-stabilized gravel. The aggregate for this course is obtained mostly from river beds, it is divided into two fractions (0-6 mm, and 6-40 mm), which are blended and mixed with about 4 percent of asphalt cement. The mixing operation is performed at temperatures between 266 F and 332 F, depending on weather conditions and the length of haul.

The Highway to the Sun utilizes modern techniques of highway engineering to a maximum extent in its design and construction. When finished it will be the backbone of the Italian tollroad network, a highway system that will enable the nation to keep pace with highway transportation needs.▲▲

Bibliography

1. For more details on this plan, see the article, "How Italy Is Revamping Its Road System," *Engineering News-Record*, August 21, 1958.
2. For a discussion of European and American standards for rural freeways, see the article, "15 Years Rural Freeway Construction," by W. Hodel, *Traffic Engineering*, January 1955.



Movable louvers protect western exposure of Clemson College's new School of Architecture building.

Air Conditioning the Colleges

MORRIS V. GELDERS & LOUIS S. BOOTH Lockwood Greene Engineers, Inc.

AIR CONDITIONING long ago became a must in theaters. It is no longer a novelty in homes and offices, and during the past five years has made considerable headway in educational buildings. For as air conditioning gained acceptance in homes and offices, the trustees and boards that formulate policies in the colleges and universities have had a second look at the problem and begun to accept conditioning for at least a portion of their plants. This was true in the deep South some years ago, but has been slower to gain acceptance in those areas where heat is not considered oppressive during the normal academic year.

CE exclusive

It remains a fact that the months of May, June, and September can be – and often are – hot and humid on campuses all over the United States. The teaching staff and students are therefore off to a bad start and a worse finish. Also, the problem of competition for teaching staff, and to a lesser degree for students, necessarily influences some institutions to install air conditioning. When one school has it, the others cannot offer less.

The Need for Air Conditioning

One of the major factors contributing to the general acceptance of air conditioning is the added impetus for attracting summer school programs and summer seminars. Formerly summer programs were held to the minimum summer school work, and these programs often dragged due to excessively hot weather. Where air conditioning has been made available, the quality of the existing summer programs has stepped up and many new ones have been added. This is particularly true of seminars sponsored by philanthropic foundations.

Although the year-round class has been tried only on an experimental basis, it is mentioned with increasing frequency as a means of getting greater utilization from the money invested in campus buildings and of reducing the time required for college training. When, and if, the year-round program becomes standard, air conditioning will become commonplace in the schools.

In practically every instance, the campus air conditioning program has started with administrative offices. This is natural since these offices are in use for 12 months of the year. Usually it has begun with the installation of a few window units. When these multiply to the extent that maintenance is a problem, the time has come to consider a central system.

The next step usually has been to air condition auditoriums, libraries, seminar rooms, and other

areas that are commonly used by all students. In auditoriums, especially, air conditioning has become a real necessity since so many programs now require blackout conditions for showing slides or films, and comfort ventilation without air conditioning is impractical. In libraries the uniform temperature and humidity conditions which can be achieved are of great benefit in preserving the life of the books – as well as the attention of the student who must read them.

These areas – the offices, the auditoriums, and the libraries – may be considered the basic areas to be conditioned, and there is little difference of opinion on the need. Beyond these there is some divergence of opinion on the justification as related to the cost. Many schools have found refrigeration of the student activity areas essential, and others have put top priority on research facilities and laboratories.

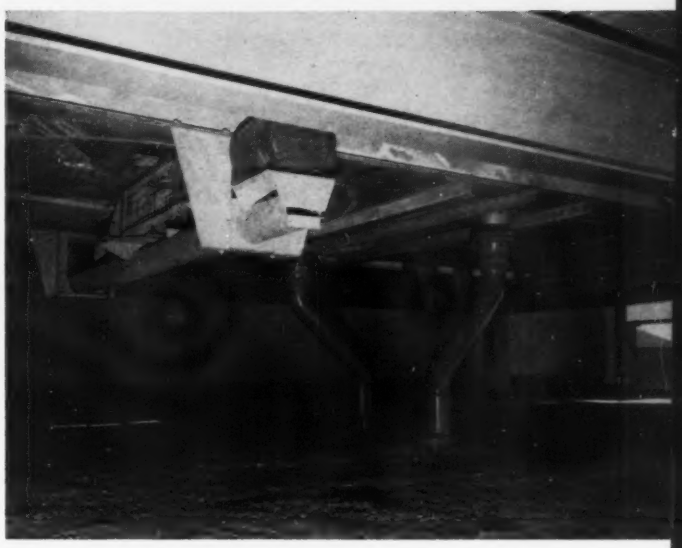
Up to now the schools have been slow in conditioning dormitories. Usually, they have approached this problem in one of two ways. First, a minimum number of dormitory rooms are conditioned and these are used in year-round programs. Second, provisions are made for air conditioning in the future, but refrigeration is not installed initially.

Up to this time few classrooms have been air conditioned. Where they have been, the approach has been much the same as in the dormitories. Classrooms which are used throughout the year have had priority, and usually this has been tied into a special technical training program.

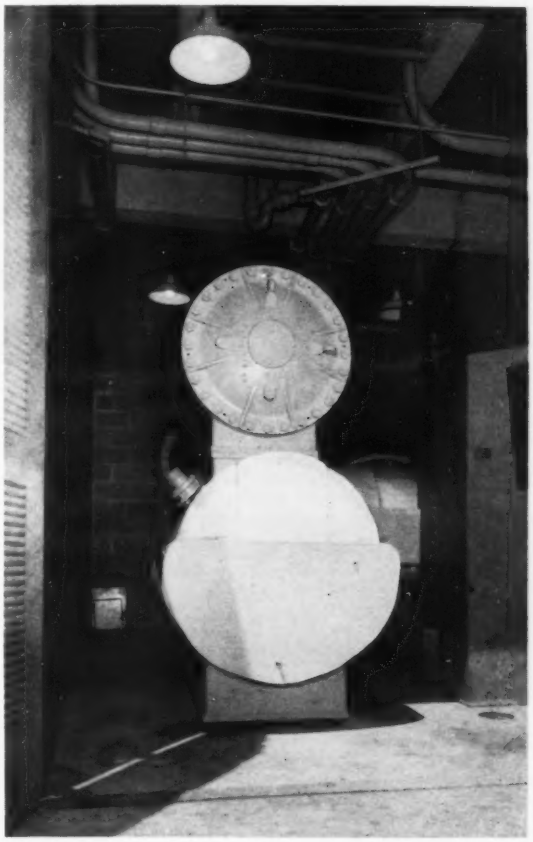
Budget Prevents Wider Acceptance

Were it not for the necessity of building and living within limited budgets there would be little question of accepting total air conditioning on the campus. Actually, in nearly every instance the cost factor plays a very important role. Colleges and universities must stretch every dollar, probably to a greater degree than in other fields of construction. The need for both funds and facilities is great. Every expenditure must be examined with reference to the total funds available, the total program, and the urgent need for improving faculty salaries. This means that there must be a convincing need for air conditioning if its use is to be approved. It also means that ingenuity in design must be exercised. Even when money is available for the total installation of air conditioning equipment, the effect of operating and maintenance costs on future budgets must be considered.

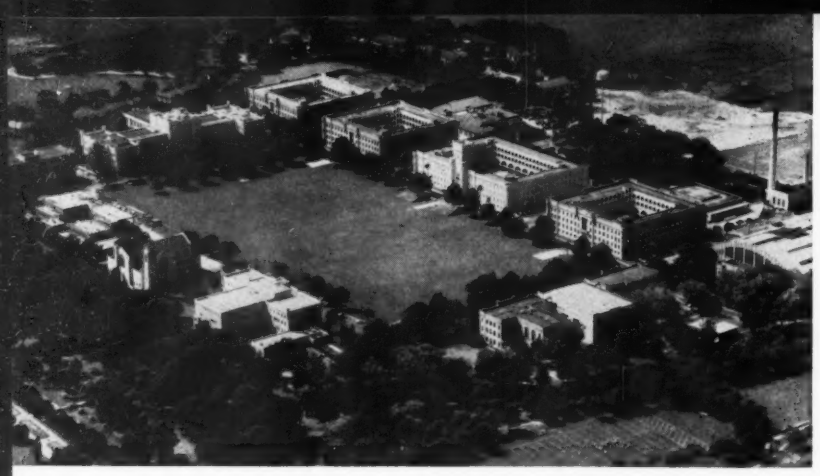
South Carolina is a state with considerable variation in climate, both from east to west and north to south. Charleston, which is located on the coast, has mild winters and long, hot, humid summers. Air conditioning there may be needed as early as



Cooling tower of Citadel system has fans at bottom to provide low silhouette and also reduce noise level.



Centrifugal compressor unit serves cooling system for Citadel's library, museum, and also two other buildings.

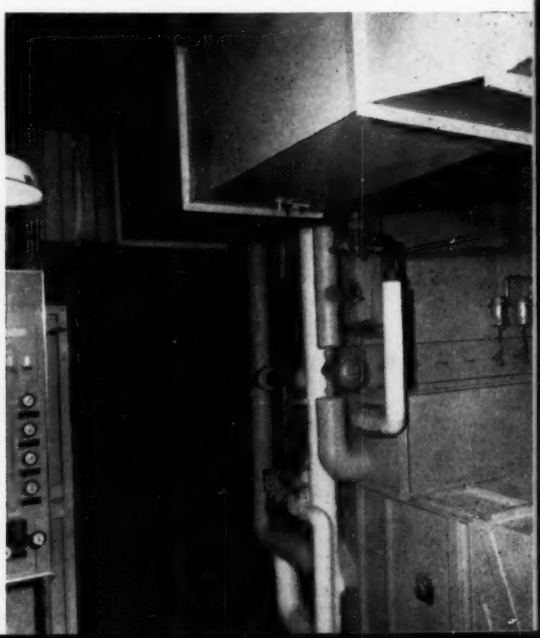


Aerial view of The Citadel campus, with three buildings in the foreground to the left of the parade ground served by a common air conditioning system. First building has air-cooled roof condenser for bowling alley.

Single, roof mounted, air-cooled condensing unit and a fan coil unit suspended at the ceiling serve bowling alley in Student Activity Building. Separate unit is provided as alleys may be in use when other areas of building are not occupied.

Citadel library is served by central system from air outlets on balcony wall. Zone controls on column. Multizone unit with individual control proportions mixture of warm and cold air to satisfy required zone conditions.

Multizone unit serving Citadel's new library and museum. Note damper motors for the five zones used. Ten zone capability is possible by utilizing all of the individual damper rods.



March and usually is in use through October. Even later there are short periods when it is desirable. The marginal periods of spring and fall decrease as you come north and west through Columbia and Spartanburg to Clemson. Clemson is located in the foothills of the Blue Ridge Mountains and seldom has oppressive temperatures at night. This variation is reflected in the extent to which the schools have used air conditioning.

During the past five years Lockwood Greene has planned air conditioning installations for many of the educational institutions throughout South Carolina. These include the Citadel, The Military College of South Carolina, Charleston; The University of South Carolina, Columbia; Converse College, in Spartanburg; and Clemson College, at Clemson. The State's range of climatic conditions and the various requirements of its schools create engineering problems which are typical of many areas in the United States which, unlike the deep South, do not require year-round air conditioning.

Equipment Selection Varies

The application of air conditioning equipment in colleges and universities is probably as varied as the equipment available. Lockwood Greene has applied units ranging from individual room conditioners to central centrifugal equipment serving multiple buildings on the campus.

Although some types of equipment are superior in quality, have greater life expectancy, produce refrigeration with less power consumption, or utilize steam produced with dump gas in summer, there are always specific areas which are better served by equipment for which none of these advantages applies. An example is the bowling alley air conditioning system installed at Mark Clark Hall, Student Activity Building at The Citadel. This bowling alley is operated as a concession and is open for business during hours and on days when no other activities are going on in the building. The Student Activities Building is served by a central centrifugal refrigeration water chiller located remotely in the library and museum, several hundred feet away. It serves the refrigeration requirements for the air conditioning of three separate buildings. If the bowling alley, which has only a 7.5 ton air conditioning load, depended on this central water chiller, there are many times when this would be the sole reason for operation of the 275 ton centrifugal unit. This would be unsatisfactory in several ways:

¶ The refrigeration load would be far below the minimum capacity of the central unit.

¶ Control of the system would be complex or would not be conveniently available to the operator of the bowling alley.

University of South Carolina Women's Dormitory has unit conditioners integrated into desk unit. Grille and access panels to controls are located in top of desk. Air intakes are located just beneath the window sills.

¶ The power requirements for pumping chilled water, pumping condensing water, and operating the cooling tower fans would far exceed the normal power requirements for conditioning only the bowling alley itself.

To avoid these undesirable features, the bowling alley air conditioning is provided by a single, roof mounted, air-cooled condensing unit and a fan coil unit suspended at the ceiling in the space. This provides comfortable air conditioning at the fingertip control of the bowling alley operator any time of the day, week, or year.

Another interesting feature of this air conditioning installation is that it conditions only the area occupied by the bowlers and spectators. Although no physical separation exists between this area and the rest of the bowling alley, no air distribution is provided to the remaining space. Only the excess air supplied for ventilation serves the

rest of the alley. Since the alley uses automatic pinsetters, this has been very satisfactory.

Multizone and Fan Coil Units

The two workhorses in the air conditioning of college and university buildings in South Carolina appear to be the multizone unit and the remote room fan coil unit. The multizone unit is the "blow-through" type having an outside and return air mixing box, filter section, fan section, coil section, hot and cold decks with damper section in that order. This unit provides a source of both warm and cold air to multiple zones diverting from the unit. The individual zone control proportions the mixture of warm and cold air to satisfy zone conditions. One fan, one heating coil, and one cooling coil are thus able to provide supply air conditions matched to several zone requirements. With the multizone unit, it is possible to heat one zone while cooling another zone with the same unit, although usually this is not done, since it makes control difficult and is uneconomical in operation. The usual application provides a cold coil in summer while the heat coil and hot deck section serve as a variable by-pass. In winter, the heating coil maintains a hot deck while the cooling coil and cold deck serve as a variable by-pass. The multizone unit has limitations and deficiencies, but when properly applied it can provide a desirable flexibility of control at comparatively low cost.

The range of air capacities now available in factory assembled multizone units extends from 1000 cfm to more than 45,000 cfm, and the number of individual zones may exceed 25 on the large units. While the continuous increase in capacity of these units is a measure of its growing popularity, it is also indicative of a trend toward serving larger zones in its application.

Where considerable individual control is desired, the dual duct type installation of remote room units usually is preferred. Some dual duct installations have been made on South Carolina campuses and more are expected in the future, but the use of remote room fan coil units are more prevalent at this time.

Remote room fan coil units may be obtained in numerous configurations, depending on the desired installation locations — ceiling or floor mounted, recessed or flush — and the type of operation and flexibility of control desired. The basic unit is a filter, coil, and fan mounted in a cabinet. It is generally 8- to 10-in. deep, 4- to 5-ft long, and 22- to 26-in. high. The cabinet type appears very similar to the familiar heating convector, except for its larger size.

Some makes of these units are exceptionally well built, quiet at all fan speeds (usually three), and attractive in appearance. They afford the air conditioning designer with the means to provide, for small areas, individual control of comfort conditions with a minimum of space required in ceilings or chases for piping and ductwork. Each unit located on an outside wall can have its own intake for ventilation air, although a central and positive supply of pre-conditioned ventilation air is preferred. These units have found a wide application in the air conditioning of dormitories, offices, and classrooms on South Carolina's campuses. Summer conditioning is accomplished by chilled water and winter conditioning by hot water in the same piping system. For special applications both hot and cold coils and also steam grid humidifiers can be installed in the units to provide an extremely versatile conditioning system.

Combined With Furniture

One interesting application of the remote room conditioner has been the dormitory of the University of South Carolina, in which the room conditioner, the room desk, and two sets of built-in drawers are combined to form one integrated unit on the outside wall. This is considered to be a forward step in providing for the fullest utilization of space in a dormitory room and suggests its application to hotels and motels. In this instance the source of chilled water was omitted from the building design since it is planned that a central steam absorption water chiller will later provide chilled water to an entire complex of buildings in the same general area.

In Williams Hall, a new 30,500-sq ft dormitory at Converse College, in Spartanburg, South Carolina, the choice of having the air conditioning system on or off, heating or cooling, is given the hostess by an attractive switching arrangement in the hallway of her suite. The system has night

Converse College visitor's suite offers individual control of room air conditioning via under-window unit.

setback control for winter operation which she can override for the entire dormitory or only for her own suite and the guest rooms, as she desires under particular conditions of occupancy.

Chilled Water Widely Used

The use of chilled water for air conditioning of campus facilities offers advantages which have made it attain a natural position of prominence. There are so many types and sizes of air conditioning equipment available for use in chilled water systems that practically no requirement encountered presents a situation without a ready solution. It is the best refrigerating medium in use from the standpoint of control, being well adapted to either precise modulation or fast on-off control. It makes possible the remote location of noisy refrigeration equipment, the central location of cooling tower or air-cooled condensing equipment, the use of heavy-duty reciprocating refrigeration equipment, or the application of the excellent hermetic centrifugal equipment available.

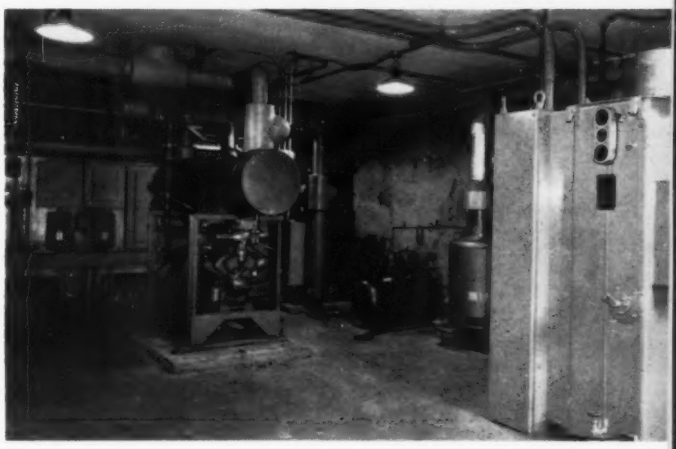
Chilled water also offers a desirable flexibility in providing for varying loads in different areas. The central chilled water plant at The Citadel's library and museum, which also serves the air conditioning needs of the 1400-student capacity Summerall Chapel and the 60,000-sq ft Mark Clark Hall, also serves a new and completely air conditioned Student Activities Building. The size of the refrigeration system was unaffected by the addition of Summerall Chapel to the air conditioning load, since periods of occupancy there will not coincide with air conditioning requirements in the other areas served.

The new Montgomery Student Activities Center of Converse College, now under construction, can have air conditioning in its spacious gymnasium even though no additional refrigeration capacity was provided for this. Chilled water will be diverted from areas normally air conditioned when the gymnasium requires it. This flexibility of a chilled water system can provide, in similar instances, the full utilization of equipment which is necessary to justify its application to areas that are used only infrequently.

Noise Levels Must Be Low

Noise is frequently the most difficult and frustrating problem in the design of air conditioning systems on campus. The noise level in dormitory rooms, study rooms, lecture rooms, classrooms, and library rooms must be compatible with the quietest

Lounge in Converse College girl's dormitory is directly over mechanical equipment room. Quiet mechanical equipment, combined with concrete beam construction and an acoustical plaster ceiling give excellent sound and vibration isolation, even though the spring isolating hangers suspend from floor above.

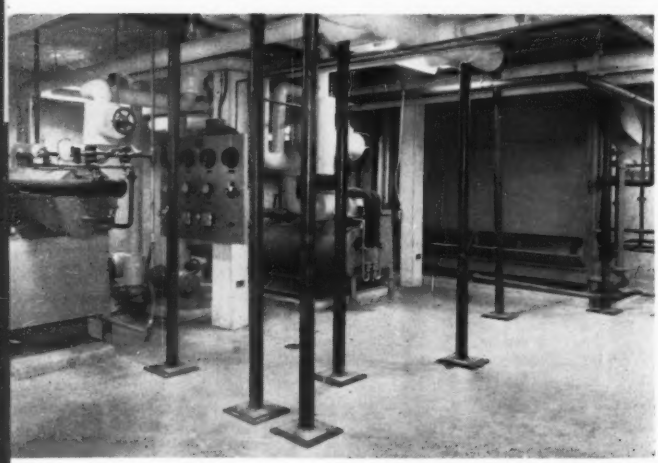


conditions which occur. The competitive race in which all manufacturers of refrigeration equipment for air conditioning engaged during the past several years brought many headaches to air conditioning designers. First came the rapid swing to direct driven, high speed, reciprocating compressors, and then the all but universal conversion to F-22 refrigerant. Both changes were unquestionably premature on the part of some manufacturers, and perhaps on the part of all manufacturers, for some of their equipment. However, the price advantages gained by both changes were too pronounced for anyone to stem the avalanche. Many improvements have been, and now are being, made to correct this situation.

Most of the major manufacturers now have introduced new equipment lines which are designed specifically for high speed operation with F-22 refrigerant. Hermetic compressors with efficient hot gas mufflers are available which appear to have noise and vibration characteristics within usually acceptable limits. In some instances the use of small, multiple, hermetic reciprocating compressors reduces the noise and vibration problem by eliminating the unloader noise and using smaller moving components.

Typical Design Approaches

The use of sound absorbing materials on ceilings and walls, the almost complete isolation of refrigeration, pumping, and air moving equipment by spring support, and the enclosure of specific equipment in sound absorbing boxes are means used to combat the noise and vibration problem. The avoidance of such problems by isolating noisy equipment is the ideal solution where this is practical, but it appears that problems of space allocation seldom permit this perfect approach.



Pipe columns supporting bar joist floor and acoustically lined boxes cut noise and vibration at Clemson.

In spite of advanced planning to minimize noise, there are many factors that arise during construction, due to conditions of construction or to variable conditions in different manufacturer's equipment that cannot be foreseen, that require careful and detailed field work on the part of the engineer. This is an important part of the field supervision and is an area in which the skill of the engineer may make all the difference between a satisfied and a disgruntled client. Noisy equipment is incompatible with the classroom or library atmosphere, and negates the advantages of comfort conditioning.

Other Problems

Another particularly objectionable problem which sometimes occurs with air conditioning is light flicker caused by frequent cycling of the refrigeration compressor during periods of mild weather. The refrigeration motor in college air conditioning is usually the largest single electrical load in the building. If power comes from a large substation, there is probably a long electrical feeder involved on some refrigeration loads, and voltage drop in the line aggravates the problem of flicker. If power comes from a small substation, the large inrush of current demanded by motor starting causes a sudden drop in delivery voltage at the substation, and light flicker results. It is often impractical to size the new electrical service, or revamp the existing one, to eliminate all objectionable voltage drop on motor starting even though reduced voltage or increment starting is used.

Where this light flicker problem has existed, two methods have been used with considerable success to eliminate complaints when compressors are large enough to require unloaders – which is the usual situation. The first method is to set the suction cut-out pressure as low as practicable, or to set the closing temperature for the last liquid solenoid valve as low as possible. This keeps the compressor on the line longer before cutting off and reduces the frequency of the starting cycles. The second method, and one that is probably unique, is to install a time-delay-to-load relay. Observations have shown that a compressor which cycles frequently will invariably go to full load immediately after starting. In so doing it is simply working itself out of a job and hastens the time when it must again cut-off. A compressor which can unload 25 percent capacity will invariably cycle on a 25 percent load because of this action. To prevent this, a time-delay-to-load relay can be installed which will not permit the compressor to load beyond its first step for a preset time interval – commonly 15 to 30 minutes. This gives the compressor a

Pipe columns with vibration absorbing pads mounted on floor support grid of structural steel which isolates piping.

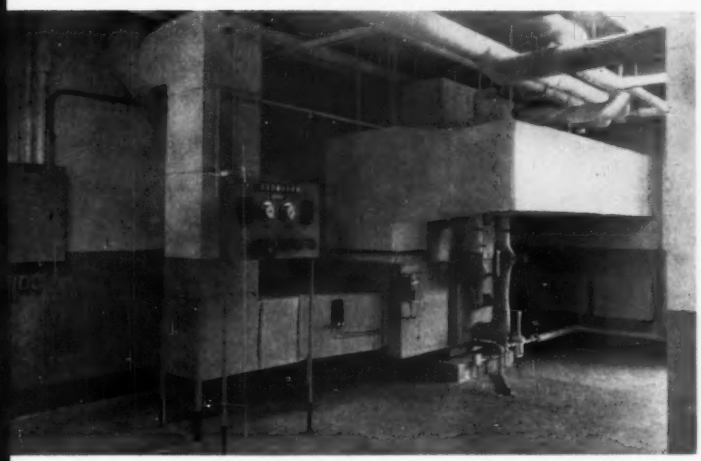
chance to catch up on a light load more slowly and often results in the compressor then remaining on the line almost constantly. With the cycles of starting and stopping drastically reduced, the light flicker occurs so infrequently that it does not serve as a constant source of irritation to students.

Need for Better Qualified Plant Personnel

The need for qualified, trained operating and maintenance personnel becomes acute when the amount of air conditioned space increases rapidly. Air conditioning is bringing to the campus a mechanical labyrinth which generally surpasses all previous demands for technical and manpower requirements. This is not to infer that the air conditioning systems are exceptionally complex, but they are invading campuses where only simple mechanical installations previously existed. In some instances, not even automatic heating controls were a part of the original mechanical equipment. Air conditioning thus becomes a giant step forward, as far as operation and maintenance of mechanical and electrical equipment is concerned.

The recruitment of skilled personnel is in many instances especially difficult for the educational institution since, to get men of the caliber needed, it is necessary to compete with industry. Not only is getting the money to attract such personnel difficult, but the salaries required may cause serious faculty dissatisfaction, particularly below the rank of full professor.

The operating difficulties are magnified in many cases, not only by the problem of getting operating personnel, but also because the educational institutions are located away from large cities. Thus, the school does not have ready access to contractors' mechanics who could help to get over early operating difficulties.



Single zone fan-coil unit heats, cools, and ventilates lecture room. Coil bypass can be used to lower humidity.

Operating Cost Not Excessive

The normal operating costs for the air conditioning of campus installations, though not to be ignored, is usually considerably less than the cost of heating during a similar average winter period. Cost of maintenance and service is generally higher and, for this reason, careful consideration should be given to design and equipment selection when the initial installation is made.

The air conditioning of educational buildings has a good start, but only a start. The growth possibilities are enormous. The opportunities and difficulties, and the growing pains that are bound to occur will be shared alike by the engineer, the owner, and the students. Together, they are involved in an air conditioned future. ▲▲

Another New York skyscraper has been reinforced with USS American Welded Wire Fabric. This is Rockefeller Center's new forty-eight-story Time & Life Building, an outstanding example of contemporary architectural design. The exterior steel columns are encased in stone-faced concrete which project from the walls and serve to accent the vertical sweep of the tower.

The frame supports short span, lightweight concrete slabs reinforced with USS American Welded Wire Fabric. Each slab is 8'0" long and 4" thick. When asked why the fabric-reinforced short-span design was selected for this structure, W. B. Scofield, partner in the structural engineering firm of Edwards & Hjorth, said "This system provides first-class, fireproof construction with a long record of satisfactory service in addition to its proven economy, speed of construction, and occupancy flexibility."

USS American Welded Wire Fabric was also used to reinforce the concrete fireproofing encasement of the columns, girders, and beams. Fabric is excellent for this application because the small, closely spaced members reinforced this thin concrete best. In addition, fabric is easily shaped to fit the contours and is sufficiently rigid to maintain the required shape.

Please write American Steel & Wire, Dept. 0248, 614 Superior Avenue, N.W., Cleveland, Ohio or contact our nearest sales office for complete information on these or any other uses of USS American Welded Wire Fabric.

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Short-span fabric-reinforced floor system in Rockefeller Center's Time & Life Building. American Welded Wire Fabric was furnished in long rolls and merely unrolled perpendicular to the beams and on top of the forms. It was draped from the top of the slab over the beams to the bottom of the slab at mid-span. Thus, the reinforcement is in position to best resist both positive and negative moments. The economy of steel placement is apparent. In total, over six million square feet of short-span slabs reinforced with Welded Wire Fabric have been used in New York's Rockefeller Center.

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Structural Engineers: Edwards & Hjorth
General Contractor: George A. Fuller Company
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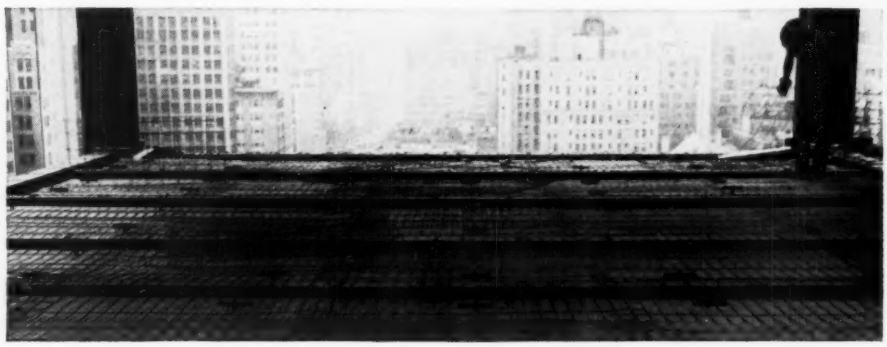
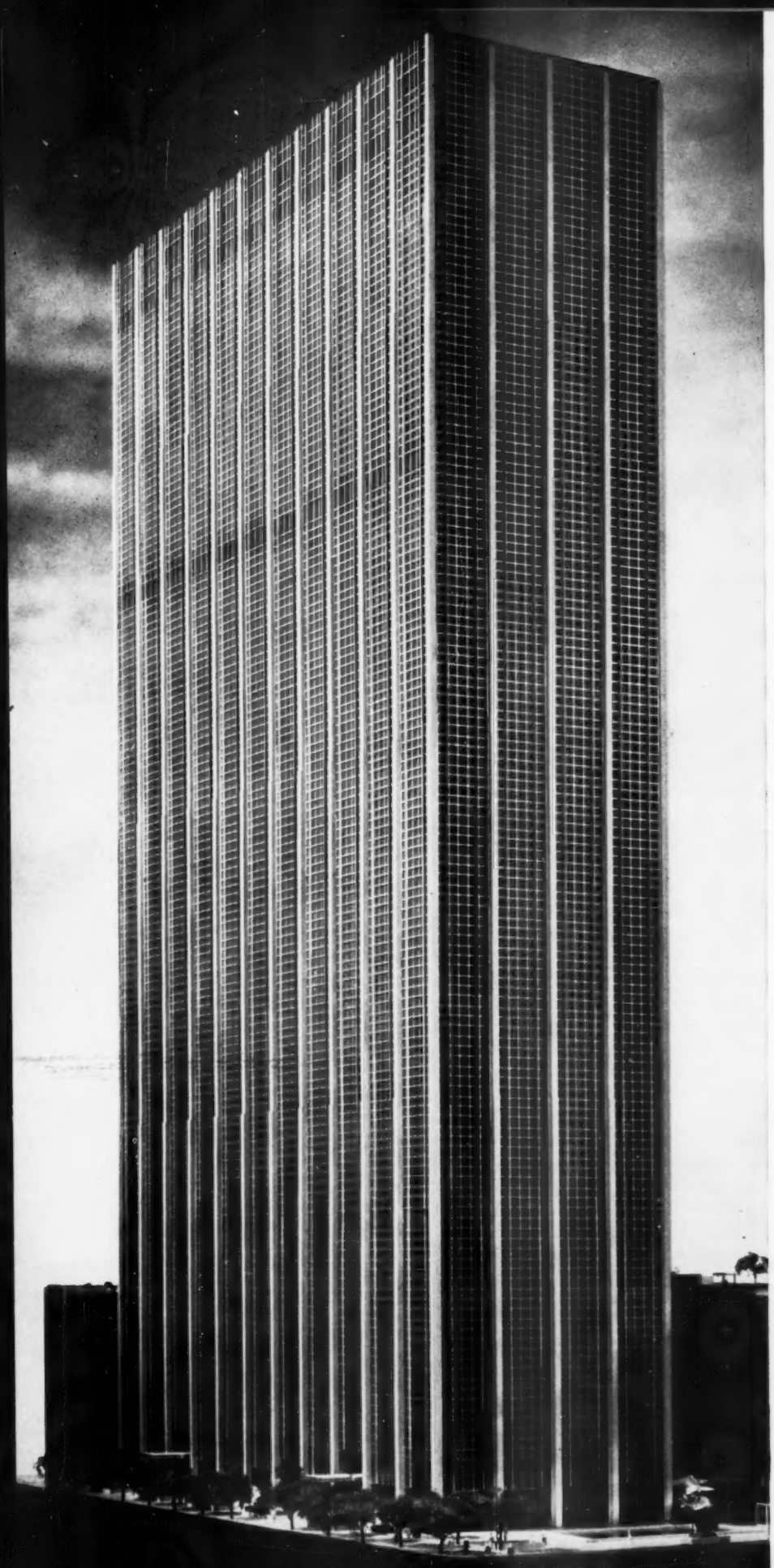
Fabric Distributor: Fireproof Products, Inc.





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Ramelli's Diverse and Artificial Machines

JAMES KIP FINCH, Dean Emeritus
Renwick Professor of Civil Engineering
Columbia University

HISTORICALLY, the earlier civil engineering works such as bridges were treated – even if inadequately – in books primarily devoted to architecture. But the invention of printing prompted a number of more specialized works in response to the broadening interests of the age. Among these, the group dealing with machines is particularly interesting. They were the pioneer texts of what was later to be known as mechanical engineering.

CE exclusive

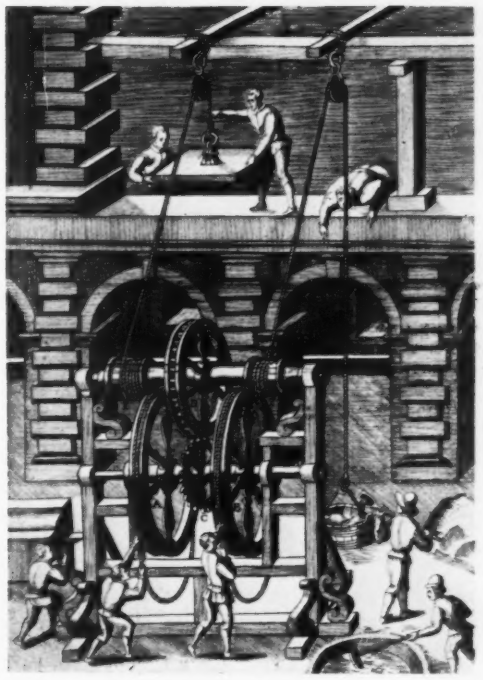
Leonardo da Vinci had, of course, illustrated many earlier inventions and mechanical speculations of others as well as his own. However, his famous *Note Books* were not published until centuries after his death. He regarded them as part of his secret stock in trade, and they had little or no influence on the professional practice of his day. On the other hand, the books on machinery which came from the printing presses of the 16th and early 17th century heralded the awakening of a new era in the exchange of professional ideas and experiences. They also reflected a new interest in machines which, although especially characteristic of the Renaissance, dated back to the 13th Century or even earlier.

There have been numerous attempts to explain this birth of interest in machines in medieval times. The devices of earlier ages had been almost entirely confined to machines of war, to hoisting equipment, and to pumps. Vitruvius briefly describes several types of water wheels and notes their use in turning mill stones. But, in general, the power needs of earlier days were met by manual labor, by man-operated tread mills, or by capstans turned by men or oxen. The horse collar, making the horse a draft animal, was yet to be invented. Earlier civilizations were based on slavery and, it is claimed, there was little need for other power. Hence, there was little incentive to further mechanical inventions.

Incentives for Mechanical Invention

By later Roman times, however, many slaves had become free and there were few conquests to bring

Fig. CLXIX — Ramelli pictured several machines such as this large hoist. It is, as he puts it, "a most necessary means for the fabrication of some edifices."



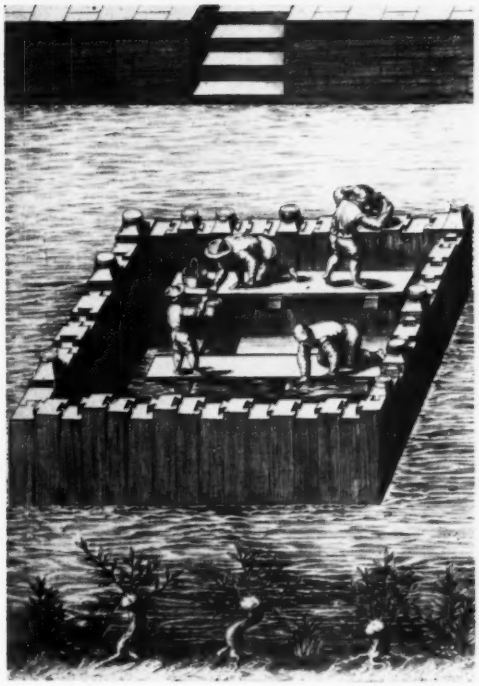
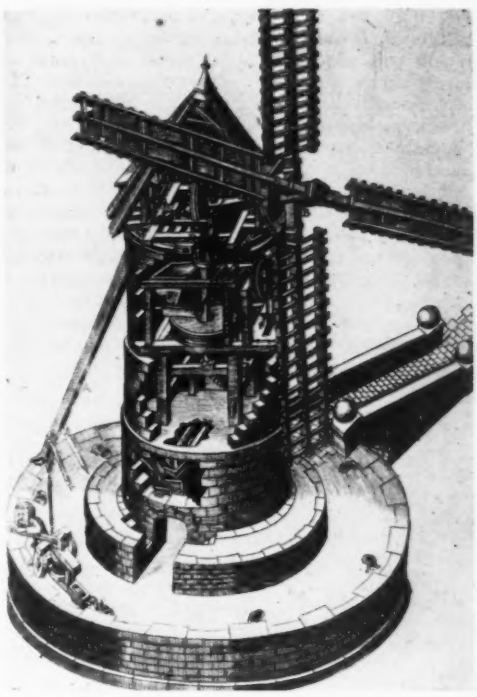


Fig. CXI — Here is Ramelli's concept of a coffer dam, "by means of which one may drain water from a port, a foundation or from similar other places, easily . . ."

Fig. CXXXII — (translation from the original text) "Here is a type of windmill which does milling by means of the wind, in the manner hereafter written. But, in order that it be better understood, it is best first to describe how this mill is made, and then speak of its movements. The mill thus is made in this manner; it is inside a tower, (as one sees it here in the drawing), the roof of which tower has all around its base many little wheels, on which it is entirely supported, and with the aid of which, and by means of the tiller marked A, this roof is turned around together with a part of the said mill, on whatever side the wind blows; which wind then with its force makes rotate the four arms, which are inserted in the axle (wind-shaft) *marked B, which goes through the said roof; on which axle is set a toothed wheel, which turns with its revolution the lantern-wheel* (pinion) *which is fixed at the top of the* (vertical) *shaft, which passes through the two stones or millstones, the said wheel catching with its teeth the spindles of the former, which by turning likewise turns the top stone, by means of the arm which is on its shaft, and is fixed in the lower part of that stone, grinding by this means the grain which falls from the hopper which is seen marked F, and empties the flour down a covered duct into the box which is on the first floor, as one can readily see by the drawing. And after when one wishes to make the four aforementioned arms stop, one tightens a ring of wood which is attached at one of its ends to the piece of wood, which one sees on the drawing marked D, and which surrounds the aforementioned toothed wheel, thus this same ring contracts and expands, by making lift and lower the rod on which its other end is fixed, by means of the rope which winds around the* (separate) *shaft of the tower, which is on one side of this mill, which tower one makes turn by means of another rope, which winds around the shaft on the third floor."*



in replacements. How much or how little slavery later existed in the Middle Ages is uncertain. It has been argued that it was the advent of machines that abolished slavery by making slaves no longer economical. But by the 11th Century, economic revival in Western Europe had resulted in the creation of a middle class and the growth of cities as commercial and trading centers. Industry and trade were at last supplementing an economy which had been almost entirely agricultural and self-contained. It seems more probable, therefore, that a decline in slavery and the building up of trade with the Near East prompted an interest in machines as a means of securing increased production.

The use of water and wind power appears, however, first to have been adapted to meet local needs. The so-called Doomsday Book or Survey of Britain in 1089, for example, records over 7500 water mills. The windmill appeared in the Low Countries and other areas where water power was not available in the 12th Century. First used to mill grain, these mills were soon equipped to saw lumber and to meet other local needs. But the late General William Barclay Parson's notes in his book, *Engineers and Engineering of the Renaissance* (Williams and Wilkins, Baltimore, 1939), that the libraries of Europe, especially Italy, are filled with early manuscript drawings of various other machines. These include a number illustrating the application of water power to operate pumps, bellows for furnaces, and other equipment. Leonardo's sketches include notes on some of these earlier devices, and Agricola's famous mining text shows the remarkable development of water power for pumping, hoisting, and other mining operations which had taken place by 1556.

Ramelli's Machines

Among the ten or a dozen early printed works that brought together some of these earlier machines

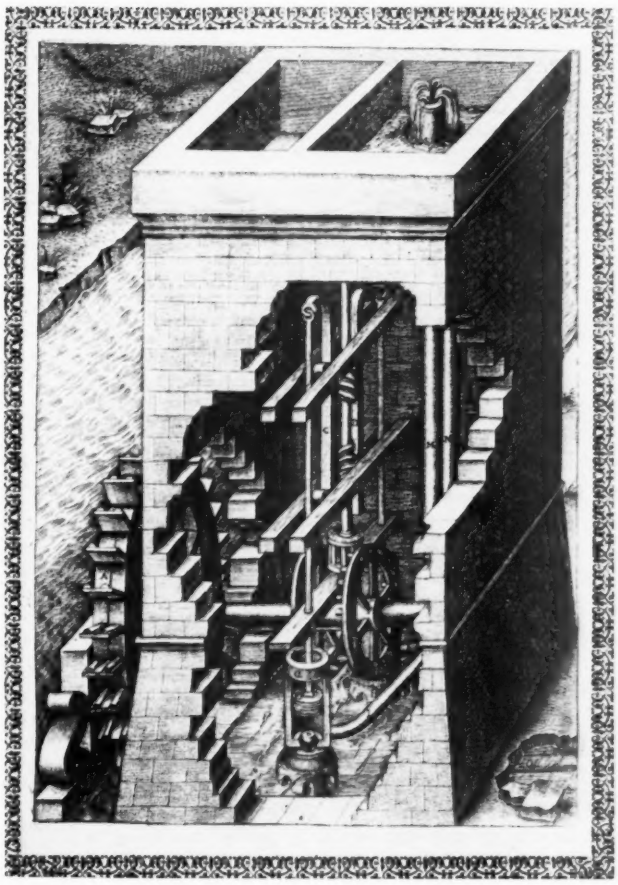
Questa è una sorte di machina, per laquale facilmente & senza punto di strepito si puo far montare l'acqua d'una fontana, ouer d'un fiume ad una proportionata altezza. Et questo si fa (come per il disegno si uede) con l'aiuto d'esso fiume, ilqual facendo uoltare la ruota segnata A, che nel suo asse ha confitte due altre piccole ruote dentate al contrario l'una dell'altra; fa con quelle tornare hora da' un canto, & hora dall'altro il rochetto notato B, nel qual rochetto è inestato un'arbore con due uiti tagliate, l'una al contrario dell'altra, che tornando (come di sopra s'è detto) fanno alzar & abbassare le due barre C D, entrando negli intagli delle uiti la madreuite delle dette barre, nella sommità delle quali sono attaccate le due braccia, che spingono & tirano li duoi mascoli, che le sono attaccati notati E F dentro a i modioli segnati G H. Sono fatti questi mascoli cò due piastre d'ottone, che chiudono, & serrano trà loro diuersi pezzi di cuoio, i quali per tali mouimenti aprono le sopate, & tirano l'acqua nelli detti modioli, & chiudendosi di nuouo le sopate del fondo de i modioli, (fatte in forma di piramide) la spingono per li condotti I L nella tromba M, al cominciamẽto della qual è un'altra sopata, come quella de i detti modioli, che si apre, & si chiude, secondo che'l bisogno richiede. Questa sopata è per trattenere l'acqua nella detta tromba, che non ricaschi. Montata che sarà l'acqua all'altezza, che si uuole per questa uia; ella si fa poi scendere per la tromba segnata N, laquale corre per il condotto segnato O sin'al luogo, doue si uorrà farla rimontare, o per far fontana, ouer altra cosa.

Et è d'auuertire, che questa sorte di sopate è molto migliore, che le accostumate da molti, perche sono più durabili, & chiudono meglio li buchi, onde non potendo l'acqua più uscire per i detti buchi, uiene spinta con maggior furia per li suoi condotti.

Fig. 1 – (translation from the original text) "This is a sort of machine, by means of which one can easily and without noise lift the water of a spring, or of a river to a proportionate (proper) *height. And this is done (as one can see from the drawing) with the help of the river itself, which by making rotate the wheel marked A, which has fixed to its axle two other small wheels toothed one contrary to the other; makes by means of these rotate now in one direction, and now in the other the pinion marked B, in which pinion is inserted a shaft with two screws cut one contrary to the other, which rotating (as was said above) make lift and lower the two rods CD, as the mother screw of said rods enters into the cuts* (threads) *of the screws, to the top of which* (i.e. rods) *are attached the two arms, that push and pull the two males* (pistons), *that are attached to them marked E F inside the cylinders marked G H. These males are made out of two plates of brass, that enclose, and compress between them several pieces of leather, which by these movements open the valves, and pull the water inside said cylinders, and, by closing the valves at the bottom of the cylinders, (made in the shape of a pyramid), push it through the conduits I L into the tank M, at beginning of which there is another valve, like that in said cylinders, which opens up, and closes, according as required by need. This valve is to keep the water in said tank, so that it will not fall down again. Once the water will have gone up to the height that one wants by this path; it is made to come down through the pipe marked N, which follows the conduit marked O until the place, where one will want to make it go up again, either to make a fountain, or for something else . . .*

and some new inventions, the work of an Italian soldier who spent his last years in France is one of the most interesting. *Le Diverse et Artificiose Machine*, written by Captain Augustino Ramelli of Ponte Tresa, "engineer of the most Christian King of France and Poland," was published "At Paris at the House of the Author and with the privilege of the king, 1588." It is a large book of over 350 pages, containing 195 full page etchings of various machines with accompanying brief explanations in both Italian and French. A German edition of much poorer quality appeared in 1633 but there seems to be no English translation.

The author of this work was born about 1531 near Maranza in the Duchy of Milan. He is said to have done especially well in mathematics at school. Later, like many other Italians in a country which then lacked any sense of national unity, he took service, under the Marquis de Marignan, with Charles V, King of Spain, who attacked Italy and took the title of Holy Roman Emperor. On the death of his commander, Ramelli was engaged as engineer by the Duc d' Anjou. Thus, he became one of a number of emigrees who aided in transferring the fruits of the Renaissance to France.



Wounded at the siege of La Rochelle in 1573 and taken prisoner by the Hugenot defenders of the city, Ramelli was ransomed by the Duke, who, when he became king of France as Henry III, granted him a pension. The old soldier spent his last years working on his one literary production, his book of machines. He died at Paris, probably about 1600.

The Importance of Mathematics

Ramelli devotes a flowery preface in his work to a spirited defense of mathematics, "Concerning the excellence of mathematics in which it is demonstrated how necessary it is to the acquirement of the liberal arts." Mathematics, he also insists, is of as much importance to the administrator of public and private affairs as to those of liberal interests. "Thus," he continues, "this presentation offers to all noble minds which, allured by beauty and truth, delight in this most excellent art of mathematics as anyone may see who will take pleasure in reading this present volume which is here offered to the reader, in which one will see all the marvellous things which nature, art or the human mind can do or knows how to perform by means of this science before the eyes of the living." Actually, mathematics plays little or no part in Ramelli's book. It is primarily a picture book with each numbered "figure" being accompanied by a brief – and not too clear – explanatory text which he designates as a "chapter."

Water Lifting Devices

A bit over half of the almost 200 figures illustrate devices for raising water. These include buckets lifted by a windlass, ball-and-chain pumps, and Archimedean screw pumps. They are turned by men, by horse capstans, or by water. He also describes what may be called tower pumps. These receive special attention, and the majority of the etchings show various types of such pumps driven by water wheels and raising water from a stream to the top of a tower for gravity distribution.

The main cities of Europe were located near streams and springs from which the people drew their water supply. By Rameli's time, added supplies were required to meet growing demands by increasing populations. A number of Ramelli's tower pumps undoubtedly reflect his own ideas and practice. He seems to have been particularly fond of worm and other types of gearing, that, in an age lacking effective metal working tools, would

have been difficult to make. Cranks and connecting rods were usually used.

Thus, about 1581 or 1582 a Dutchman, Peter Morice or Morris, built an early system of this type for London. Water wheels in a passageway of Old London Bridge were driven by the tidal currents of the Thames to operate pumps which delivered water through bored-log pipes. Similarly, in 1602, Henry IV of France ordered Jean Lintlaer of Flanders, "my engineer," to build a famous tower pump known as "La Samarataine" in an archway of the Pont Neuf at Paris. The greatest of all such machines was that built at Marley on the Seine in 1689 to supply the fountains of Versailles. It is interesting to note that the first Paris pump, reconstructed at various times, remained in service until 1813 and that another similar installation, built later at the Pont Notre-Dame, was in use in modified form until 1858.

Over a score of Ramelli's later drawings show various forms of grinding mills turned by man, by horse capstan, by water, and by wind. In fact, Ramelli's windmill figures offer, it is believed, the first known data on the interior mechanism of the windmill. One cutaway drawing shows a mill in which only the cap or top is turned to direct the sweeps with their sails (whips) into the wind. The following figure shows the earlier post type, in which the structure turns about a central post.

Other Devices

A half dozen or more designs of "contrivances convenient for lifting heavy weights" appear to include some ancestors of the great heavy cranes that are used in modern naval yards. An up-and-down wood saw is characteristic of the age before the advent of the circular saw, and a similar but horizontal group of stone saws shows the early use of this method for producing stone slabs.

One wonders how many of Ramelli's offerings represent the actual practice of his day and how many are pure inventions and suggestions. Two of his figures, for example, show what has become known in recent years as interlocking sheet piling. Water may be held back "easily and promptly," he says, in foundation work with this grooved timber piling. In a subsequent figure he suggests dewatering the enclosed space with a number of curious man-operated pumping devices, a balanced tipping arm on the inner end of which a bucket dips up water and then automatically dumps it into a discharge trough. The major problem with Ramelli's sheet piling was the difficulty in driving it without a power pile driver, and apparently the proposed pump was not a very effective device.

Ramelli, of course, had a particular interest in military matters and he shows several pontoon and other military bridges that could be quickly thrown across a river. A number of screw-jacks are also illustrated, both for raising weights and for bending or cutting the bars protecting the entrance to a stronghold. It is also interesting – and surprising – to note the persistence of ancient stone throwing devices in an age of gunpowder and cannon. This is reflected by four figures of the catapult type. "Here we have another kind of machine," says Ramelli, "which is very useful and suitable to aid in the defense of a city or fortress . . ."

Figure CXCV shows cannon with a device for measuring inclination and directing fire, but, apparently Ramelli thought machines which would throw great showers of stones and darts still had value in a day before grape shot and shrapnel had been invented. In sharp contrast with this continuation of earlier practice Figure CLII shows an amphibious military boat-wagon, a paddle wheel boat on wheels, which anticipates by over three centuries the tanks of World War I.

Ramelli's Book Not Complete

As is so often the case with these fascinating early works, Ramelli's book does not cover the entire range of the machines of his day. An earlier French work, *Theatrum instrumentorum et machinarum*, by Jacobus Besson, published at Lyon in 1582, illustrates a number of other interesting devices including a lathe for turning oval and other shapes in wood. Vittorio Zonca's *Novo teatro di machine et edificii* printed a bit later at Padua in 1607, includes, among other machines, some of the early devices for combing woolen cloth and a silk spinning machine driven by water power. These record the early advances in textiles – soon to become a major world industry.

France carried on the leadership in engineering in the 17th and 18th Centuries, and it has been argued that she owed far more in her mechanical advances to workers from the Low Countries than to such "importations" from Italy as Ramelli. It is true that the Low Countries did pioneer in the industrial development of Western Europe. The many rivers of Belgium and Holland provided an easy means of access in an age when overland transport was difficult and costly. This prompted trade which in turn encouraged industry and mechanization. Indeed, several mechanical experts from the north were later called to France. But the early industrial development of modern Europe was undoubtedly aided and abetted by material drawn from many sources. A classic in the history of invention and the rise of mechanical engineering, *The Diverse and Artificial Machines* of the old Italian Captain, Augustino Ramelli, reflects this wider interest. ▲▲

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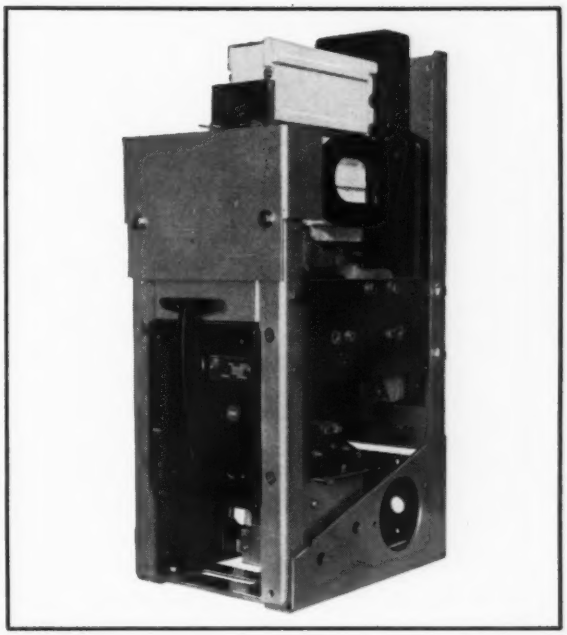

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ENGINEERING ETHICS . . .

The Search For A Single Code

HUNTER HUGHES, Editor

ENGINEERS, as a group, have a tendency to excuse themselves when caught in a bit of professional naivete by explaining that engineering is a young profession. It does not, they say, have the ancient heritage of medicine, theology, or the law. This is in one sense true, for engineering never has been accepted by the public as one of the learned professions, and the first college degrees in engineering go back only to the early 19th century. Yet, to claim youth as an excuse for ethical immaturity is not entirely logical. A modern profession presumes the existence of an organization or group of organizations that represent it and a code of professional ethics by which its practitioners are presumed to abide. In fulfilling these specifications, engineers are not historically young.

CE exclusive

The American Medical Association was organized in 1847 and reorganized in 1901. Its code of ethics, known as "Principle of Medical Ethics," was adopted in 1912.

The American Bar Association was formed in 1878. Its "Canons of Ethics" was adopted in 1908.

The American Institute of Architects was founded in 1857. Its "Canons of Ethics" go back only to 1909.

When compared with these organizations and the dates they adopted canons or codes, engineering does not seem young at all. The first American engineering organization was the Boston Society of Civil Engineers, which was organized in 1848, and this was soon followed, in 1852, by the first national group, the American Society of Civil Engineers. The Civils discussed a code in 1893 and adopted one in 1914. It was, even at that date, by no means the first national engineering society in this country to adopt a code. The first code was adopted in May

1911, by the Council of the American Institute of Consulting Engineers. The American Institute of Electrical Engineers, first Founder Society to have a code, adopted one on March 8, 1912. The American Institute of Chemical Engineers adopted a code in December of 1912, and the American Society of Mechanical Engineers followed in June of 1914, just three months ahead of the Civils. So, American engineering societies are, like the societies of the other professions, creatures of the middle and the latter half of the 19th century. Their codes of ethics are, for the most part, products of the first 15 or so years of this century.

Engineers cannot excuse their relative ethical backwardness by attributing it to professional youth. There is, however, a backwardness, and there must be some explanation of it, for engineers, as men, are no less ethically developed than their contemporaries in medicine or law. It is in the area of professional ethics, not personal ethics, that engineers have failed.

There are two major contributory factors. The first is the lack of organizational unity in engineering. The second is the employee status of the great majority of engineers. Together these constitute an enormous handicap not forced upon either law or medicine – or for that matter, architecture.

In the Beginning

It was on November 5, 1852 that a small group of men, in the New York office of Alfred W. Craven, chief engineer of the Croton Aqueduct, founded the American Society of Civil Engineers and Architects. The use of the word "Civil," it is claimed, was to differentiate these men not only from military engineers but also from locomotive engineers, then represented by the most powerful union in the country. And the Society was to include not only engineers but also architects. This was, indeed, a unified, all-encompassing, professional organization.

The Society met with some regularity for about 30 months, but there were no meetings between March 2, 1855 and October 2, 1867 – a gap of 12½ years. James Laurie, the first president, called the reorganization meeting. In November 1867, the second president was elected, and it was during his term that the name of the society was changed to the American Society of Civil Engineers. Architects were no longer included, for the American Institute of Architects (1857) had been organized dur-

ing the 12 meetingless years. It is proper, perhaps, to think of AIA as the first of the "splinter" groups.

The Miners Break Away

Having been divested of its architects, the American Society of Civil Engineers managed to exist in solitary engineering splendor for only a few more years. In 1871, some of its members and a number of nonmembers, interested principally in mining, set up a separate society known as the American Institute of Mining Engineers (later the American Institute of Mining and Metallurgical Engineers, and still later, the American Institute of Mining, Metallurgical and Petroleum Engineers). The reasons for this splitting off of a group that certainly could have functioned as a technical division of the Civils is not now entirely clear. It generally is explained as a natural outgrowth of the explosion in technology in the last half of the 19th century. Engineers were becoming more conscious of their specialties. Mining and metallurgy grew too fast for the Civils in an era big with iron, steel, gold, copper, and lead. The Civils with their roads, bridges, and canals were not progressive enough (even with their railroads) for the Miners, the young Turks of the profession.

That explanation may contain much truth. Certainly the existence of a great many bright, active, and ambitious mining engineers in the newly opened West provided a healthy potential membership for the new society. But another reason for the Institute's organization undoubtedly involved professional politics and some frustrated members high up in ASCE. The conflict surely had something to do with disagreement over qualifications for membership. The Civils, soon after they began meeting regularly, took the position that membership should be regarded as an honor and should go only to those recognized as distinguished and respected professional men. The Miners, out of the wilder West, were not such sticklers for position and felt that engineers should be judged less by their degrees and more by their practical accomplishments. They further argued that those who were of lesser stature could gain professionally by associating with the good and the great.

It was the familiar argument. Should a professional society limit its membership to the professionally pure, or should it open its doors to the sinners and convert them? The Civil-Miner split was the result of the first but certainly not the last of these conflicts.

And Others Follow

In the following years group after group branched out on its own. The Mechanicals (1880) followed only a few years behind the Miners, and then came the Electricals (1884) and the Chemicals (1908). (The American Institute of Chemical Engineers, organized after the turn of the century, had to wait until 1958, its 50th anniversary year, before the earlier four agreed to admit it to the select group known as the "Founder Societies.")

Not only did these groups break off one by one, but slightly subprofessional groups broke off from them (i.e., the American Society of Heating and Ventilating Engineers). There was not only division according to branch of engineering but also geographically until there were, by 1910, hundreds of societies — local, state, regional, and national.

This process of multiplication by division has had a detrimental effect on professional ethics. The American Medical Association and the American Bar Association stood well established as the unity organizations of their professions when, in the early 1900s, they adopted their codes and canons of ethics. But there was no one national organization to stand up for engineers and say, "This is the way we should act." The doctors and the lawyers had strong central governments that not only could adopt codes of ethics but could build up casebooks and enforce decisions of their ethical committees with meaningful threats of censure or expulsion.

In contrast, by 1910, all the five engineering Founder Societies were fully functioning. They were competing one with the other for membership and prestige, and they engaged in no joint efforts worth mentioning. Their only real tie was the United Engineering Trustees, which controlled the old Engineering Societies Building on 39th Street into which the Miners, Mechanicals, and Electricals had moved in 1906. Carnegie's money provided the building, yet the Civils, according to Frederick H. Newell, writing in 1922, resisted for 10 years all efforts to bring them under the same roof with the "less professional" Miners. E. L. Chandler, of ASCE, says it was not snobbishness but simply that, "ASCE had built its own building, at 220 West 57th Street,

and moved into it in 1897. Thus, it had hardly settled into its specially planned home when activity began on the 39th Street development. It was a difficult situation which naturally called for a lot of important readjustments."

The engineers had no means to work together to compose or adopt a joint code of ethics for the whole profession, and if one had been agreed upon, there was no method for enforcement. It even was argued that a single code of ethics was undesirable because the several branches were so different that each required a different code. Lack of organizational unity was clearly a serious detriment to efforts toward a common code of ethics for engineers.

The Employee Status

The other major handicap was the predominately employee status of engineers. The percentage of engineers in private practice was extremely small in the early years of this century. The reverse was true for doctors and lawyers. For this reason, medical practitioners and attorneys could be held accountable by their societies for their professional actions. The great majority of engineers, as employees, acted as they were told to act or lost their jobs. And since their employers were men of business, the ethics of employee engineers were at best business ethics and at worst simply the laws of the commercial jungle.

It is likely that employee engineers saw little need for professional codes of ethics, since it was up to their bosses rather than to them to abide or refuse to abide. And this explains why it was that the American Institute of Consulting Engineers, the only group made up entirely of men with their own private practices, was the first organization of engineers to adopt a code of ethics.

The First Codes

It was the Electricals, however, who should get credit for the first effective efforts toward a code. In May 1906, when the American Institute of Consulting Engineers was still no more than a name and a hope, Dr. Schuyler Skaas Wheeler delivered his presidential address on "Engineering Honor" to the Milwaukee convention of AIEE. The delegates liked his ideas and asked that they be embodied in a code of ethics for the electrical engineering profession. In October, a committee, made up of Dr. Wheeler, H. W. Buck, and Charles P. Steinmetz, was appointed, and it reported a code to the president and the board of directors at the June 1907 convention, at Niagara Falls. It was adopted at the convention, but it had to be set aside when the parliamentarians discovered that the constitution prohibited conventions acting on matters of policy. The code then was revised slightly, printed, and distributed to the membership for study. It lay dormant until 1911, when a new committee was appointed. With a new title, "Code of Principles of Professional Conduct," it was adopted March 8, 1912. So, after some struggle, it came into being as the first conceived but second born code of ethics for engineers in the U. S.

Meanwhile, the American Society of Mechanical Engineers had not been unmoved by the growing interest in professional ethics. In 1910, the Council of the Society "approved the appointment of a committee to consider respecting the advisability of the Society's preparing a code of ethics." A committee of three was appointed, but it must not have done well, for the size was changed to five and the original three were not reappointed. The committee of five was headed by Charles Whiting Baker and had as members Charles T. Main, Col. E. D. Meier, Spencer Miller, and C. R. Richards. This group presented its code to the Council in December 1912. The proposed code was published and the membership was "invited to make suggestions and criticisms." The report was "made a matter of discussion by the Society as a whole at its semiannual meeting held in Baltimore in 1913." Later, in Octo-

ber, the membership was polled, and the code got a favorable ballot. It became official in June 1914.

Just three months later, the Code of Ethics of the American Society of Civil Engineers was adopted (September 2, 1914), and it is still in use today though in a considerably revised form.

These early U. S. codes were preceded by the simple six point code of the (British) Institution of Civil Engineers, which was founded in 1818, and the quite similar code of ethics of the Engineering Institute of Canada, an organization incorporated in 1887 as the Canadian Society of Civil Engineers.

Criticized Then Forgotten

None of these codes adopted before World War I had much to say about the engineer's obligation to the public. In 1922, Morris L. Cooke, a consulting engineer, condemned all of them, British and American alike, as "obsolete codes . . . drafted under the conception that engineering was a craft and that those who practiced it constituted a fraternity and as such owed a higher obligation to fellow practitioners than to the public."

Professor A. G. Christie, also writing in 1922, took a somewhat different position. He felt that "These committees did excellent pioneer work and wrote some splendid codes which, when analyzed, show that the same high motives prevailed in the various branches of engineering, although expressed differently in the several versions." He admitted, however, that "Naturally, there were some points on which the different codes were not in agreement. A difficulty arose when the question of administering these codes came up for consideration, due to the fact that what was forbidden in one code might be tolerated in another. The engineer who belonged to more than one society was frequently in a dilemma from these conflicting rules." It is not likely, though, that the dilemma was too serious for many engineers, for in his next paragraph Professor Christie acknowledged that already (1922) the codes of ethics of the engineering societies "have generally been forgotten." To prove this, he says, "Even the president of one of the national societies recently ruled from the chair that the society had no code of ethics, as he was not a member when one had been adopted several years earlier, and it had never been called to his attention since he became a member."

The Postwar Revival

If the codes were forgotten during the War years, there was a revival of interest in the early '20s. Every profession, semiprofession, and business that had not adopted a code of ethics before the War got one soon after. In engineering, there was an enthusiastic movement toward organizational unity in the form of the Federated American Engineering Societies, formed in 1920 out of the Engineering Council of the National Technical Societies of America (1917). Herbert Hoover was its first president. It functioned through its American Engineering Council, composed of representatives from its member societies. Unfortunately, the Civils refused to join until 1929, and since ASCE is the "most Founder" of the Founder Societies, the new group was at something less than potential strength during its early years. While it ranged in membership from a low of 19 societies in 1932 to a high of 54 in 1940, most of these were state or local organizations. It was supported largely by the Mechanicals and Electricals until the Civils finally joined.

This somewhat less than ideal unity group was at first looked upon as the logical organization to take on the preparation of a common code of ethics for the profession, but this never occurred. Professor Christie excuses it by explaining that the American Engineering Council "had already undertaken the investigation of waste in industry, and other urgent matters were demanding its attention. It was therefore thought best to leave the matter of a common code of ethics with the member societies." One familiar with the functioning of the boards and councils of national engineering societies could suspect that another reason lay in the inability of the several affiliated societies to agree even on the need for a code and the fact that the Council did not at that time have the support of either the American Society of Civil Engineers or its young but growing rival, the American Association of Engineers.

Christie's Joint Committee

So the American Engineering Council ducked the question of a common code, and it was left to a Joint Committee on Code of Ethics, composed of representatives from the Civils, the Miners, the Mechanicals, the Electricals, and (appearing for the first time in this sort of joint activity) the American Society of Heating and Ventilating Engineers. There also was an observer from the Engineering Institute of Canada.

The Mechanicals should to be credited with getting this Joint Committee under way. According to Calvin W. Rice, then secretary of ASME, a Committee on Aims and Organization, in 1918, asked that a committee of five on Code of Ethics be nominated by the president. This was done (Professor Christie was chairman), and this committee reported to the ASME Council in April 1920. The job of this committee was to write a new code and consider means for enforcing it. The committee recommended, according to Rice, that "a code should be common to each branch of the profes-

sion, and it was therefore offered to the other engineering societies for their consideration. This was the beginning of the efforts for a joint code. . ."

Professor Christie then became chairman of the Joint Committee, and in 1922, it reported back to its societies with "A Code of Ethics for Engineers." This was a 10-item code that was the best piece of work on ethics done by engineers up to that time. It included something from early, neglected codes, but it much condensed the concepts and dropped out many of the details dealing with ownership of patents or drawings, In fact, in many ways, this code is better than any code or canons since prepared. Christie says Dr. John C. French, then professor of English at Johns Hopkins, "very skillfully consolidated and reworded the clauses until it was in its final form. It was written in positive language, and one could remember its specific admonitions."

The American Association

It is to be noted that the American Association of Engineers was not represented on this Joint Committee. This is an important omission, for in 1922 the American Society of Civil Engineers had something over 9000 members while the American Association of Engineers, just founded in 1915, had over 22,000 – most of them civil engineers. It was explained in contemporary writings that ASCE had taken no interest in compensation for engineers, and this indifference to pay and individual welfare brought about the breaking away of a large number of younger men who "found an outlet for their energies and an opportunity for helping each other through joining the more progressive American Association of Engineers." This explanation, provided by Frederick H. Newell, probably explains rather accurately the startling growth of the new AAE. But H. W. Clausen, the Association's treasurer in 1922, says that "Although many reasons prompted the creation of this Association, it may be said that the desire on the part of its organizers for definite machinery capable of adequately and promptly handling the various problems relating to the ethics of the engineering profession was the principal thought in mind."

By the time that Professor Christie's Joint Committee had begun to function, the American Association had, for several years, been using a code written by Isham Randolph, of Chicago. It was a short code, well written and fully conscious of the engineer's obligation to the public, but it was rather general and lofty. It could serve only as a foundation upon which a common law of ethical case histories could be built. This is just what the American Association had in mind, and by the time Professor Christie's Joint Committee submitted its final report, in 1922, the Practice Committee of the AAE already had heard and rendered decisions on 19 cases of alleged unethical conduct.

AAE's Case 15 is a good example of the type of case studied and the style of decision rendered.

> *Case 15* – A firm of engineers by name of A, located at B in state of C, advertises and sells its services as consulting engineers. It is also manufacturers' representative for several of the largest manufacturers in the U. S. Among others it acts as consulting engineer for the city of B, and on work which it recommends and on which it writes specifications, it also gives prices to contractors and bids on machinery.
> *Question* – Is it ethical for A to sell its services as consulting engineers to the city of B and also, acting in the capacity of sales engineer or manufacturers' representative, to furnish prices on the commodities that it sells to contractors bidding on the work of city B when A makes a recommendation of award?
> *Answer* – Generally, no. There might be a peculiar combination of circumstances where this might be correct, but never should it be undertaken without the fullest of publicity and then only in cases where the public interest demands it.
> *Question* – In the above, would the situation be altered if A made a direct bid to City B for the required commodities or machinery?
> *Answer* – Generally, no. Exception under conditions mentioned above.
> *Question* – As a general policy is it ethical for engineers to design work or write specifications for clients and also have an interest, direct or indirect, in the materials, equipment, or other things going into the construction work of the clients?
> *Answer* – As a general policy it is not ethical for engineers to have an interest direct or indirect in the materials, equipment, etc. going into the construction work of their clients except that the clients be advised in advance of the nature of the interest of the engineer and sanction of the client be obtained.

It can be seen that the agent-engineer conflict of interest is nothing new.

The American Association must have felt that it was considerably ahead of the Joint Committee and the participating organizations, and therefore it felt no need to take part in the joint project. Professor Christie says that he recalls that the Association was invited to participate despite some coolness on the part of the Civils, for he and his Mechanicals certainly had no objection to them. But the American Association was feeling rather "chesty" at the time, as Christie puts it, and declined the invita-

tion. It looked upon itself as an action group in contrast with the older societies, ASCE in particular, which it saw as a solid mass of inertia-ridden reactionaries incapable of progress.

It also was claimed by the American Association of Engineers that the older societies failed to enforce their codes, such as they were. The Association insisted that wherever there had been any action by the Founder Societies, it had been in executive session of their boards, and actions, if any, were hushed up not only from the public but even from the members. How AAE intended to change this is not clear, for it did not state that it was going to publish both names and cases involving infringement, but it did seem to feel more keenly the need for enforcement than did the older and more conservative organizations.

It could be that this criticism had some effect on the Joint Committee, for it, too, propounded a thorough system of enforcement of its code, to be adopted by the participating societies. Professor Christie says his Joint Committee realized that interpretations of its code would be needed and recommended that each society have a standing committee on professional conduct and that these committees exchange interpretations. Christie served as chairman of such a committee of ASME for five years during which time many inquiries were referred to the committee. "My recollection is that several members were dismissed from the Society, on the recommendation of our committee, for unprofessional conduct. No publicity was given to these cases to avoid legal actions for redress."

There were, then, in the spring of 1922, two separate engineering groups engaged in the study of professional ethics: the Joint Committee, made up largely of the Founder Societies, with headquarters in New York; and the American Association of Engineers, revolving about Chicago as a center of gravity. Unfortunately, neither group succeeded in developing a code of ethics acceptable to the whole profession or even a sizable portion of it. Professor Christie recalls that several of the societies, including the Mechanicals, did accept the code recommended in his Joint Committee's final report, but the Civils, again, did not. They preferred their own 1914 code, which they considered more specific and more directly applicable to civil engineers. With this lack of general acceptance, the Joint Committee's code and report languished.

The American Association of Engineers continued to drift into left field, concentrating on income and working conditions of engineers in industry. The depression of the '30s saw its efforts in this direction increase but its membership decline. It expended most of its energies acting as a referee in engineer-management labor disputes. It never recovered its strength of the '20s, but it is still in existence today. Its energetic young men now are mostly retired. The manager, still working each day in the Chicago office, is now 96.

The Independent Committee

The thread leading to a common code never was lost, however, for Professor Christie's Joint Committee rose again in the new form of an Independent Committee, with the Civils, the Miners, the Mechanicals, the Electricals, the Society for the Promotion of Engineering Education, and the American Institute of Consulting Engineers each having a member. For a brief period, just before it went out of existence, the American Engineering Council sponsored this Independent Committee, giving it a home. In the last budget of that Council (1940), the executive secretary referred to this group and its need for "additional expense of probably $6000 to provide another man, with other expenses, to act as secretary for engineers studying and reporting on (possibly): A – Code of Ethics (or Professional Principles) for Engineers. . ."

ECPD and the Canons

Some eight years earlier (1932), the Engineers Council for Professional Development had come into being. Its purpose was "to coordinate and promote efforts to attain higher professional standards of education and practice, greater solidarity of the engineering profession, and greater effectiveness in dealing with technical, economic, and social problems." Despite this elaboration of generalities, its real purpose was the accrediation of curricula in engineering schools of the United States and Canada. It developed its interest in ethics in January 1941 (following the 1940 demise of AEC). Just as AEC had adopted the Independent Committee, so ECPD took in the whole orphaned brood.

Since ECPD had three member societies in addition to those represented on the Independent Committee as it stood, it became necessary to add a representative from the National Council of State Boards of Engineering Examiners, the American Institute of Chemical Engineers, and the Engineering Institute of Canada. This eight-man committee, representing nine societies (the chairman represented both AIEE and AICE), thereby became the Committee on Principles of Engineering Ethics

of the Engineers Council for Professional Development. Its members were: J. W. Barker, SPEE; Arthur W. Dean, ASCE; Martin H. Ittner, AIChE; William H. Kenerson, ASME; Charles F. Scott, NCSBEE; Scott Turner, AIME; C. R. Young, EIC; and Chairman Dugald C. Jackson, AIEE and AICE. Jackson, it is worth noting, had served on an advisory committee that was working on the AIEE code back in 1911, so he had by this time over 30 years experience with codes of ethics. He continued to serve as chairman until his death in 1948.

This Committee submitted its first report in 1941. It makes mention of preliminary work done by the original Independent Committee before ECPD took over sponsorship. It speaks of a first draft of a Canons of Ethics, followed by a second draft, "which seems to be receiving a good deal more favor from members of the Committee than was received by the first draft." A third draft is promised, and the hope is expressed that the Canons may be presented to ECPD in Committee-approved form at the 1942 Annual Meeting. The report also mentions that Committee members were being taken from their regular occupations into defense activities.

Discord Still

In 1943, the Committee gave a short report that indicated more discord than harmony. "Three of the societies (SPEE, AIEE, and AICE) have approved the proposal in phraseology and arrangement. Two of the other societies (ASCE and ASME) have made reports which are somewhat interdestructive, as omissions of items from the proposed Canons suggested by ASME would exclude items from the old-time Code of Ethics of ASCE, which the latter society wishes to maintain in its present form; also, the latter society includes items in its separate Code of Practice which are obviously items of ethics; and the separation of the ethical items thus made is an additional element of confusion. The other four societies have not yet made their reports.

"The fullest report comes from the Council of the American Institute of Consulting Engineers (AICE) which adopted them with a suggested rearrangement of their order in the formulation."

Meanwhile, the Engineering Society of Detroit got tired of waiting and adopted the preliminary Canons, agreeing to just go along with whatever modifications might ultimately be agreed upon. It thereby became, in 1943, the first engineering society to adopt the Canons of Ethics for Engineers.

The rearrangement supported by the American Institute of Consulting Engineers became known as the "Singstad Draft" (for Ole Singstad, of course) or "Alternative Draft," and this was adopted with just a few minor changes by the Engineering Institute of Canada (a member of Engineers Council for Professional Development since 1940). This version, again with "some slight modifications" was approved by ECPD and recommended to its constituent societies. Seven of the eight "assented" in October 1947, and the Electricals adopted the Canons a month later. There is a difference between *assenting* and *adopting*, for the Civils did not officially adopt the Canons until 1950, and even then, they adopted them in addition to, and not to the exclusion of, their old code.

The National Society of Professional Engineers, founded in 1934 but not a member of ECPD, had not waited for the final version of the Canons to work its way through all constituent societies. It adopted the still shifting Canons in October 1946.

By 1955, the ECPD Ethics Committee, headed by Scott Turner, consulting engineer and a member of the original group that did the preliminary work on the Canons, was able to report that 82 engineering societies had adopted them. This included such strange bedfellows as the still barely breathing American Association of Engineers, the healthy and rapidly expanding National Society of Professional Engineers, all the Founder Societies (by now loosely affiliated in Engineers Joint Council), and other societies great and small.

One would have thought that the adoption of a common Canons by such a multitude of societies would have stopped, or at least slowed, the preparation and promulgation of additional codes, but this was not true. ASCE even now feels that its own code is the vital one so far as its members are concerned. It would appear that the Civils went along with ECPD on the Canons just to keep from looking lonesome. They increased their ethics activities during the '50s and made several important changes in their own code.

The National Society of Professional Engineers, since its organization, has been much interested in

the ethical aspects of the profession. Its Ethical Practices Committee, during a two-year period in the late '50s, developed the "Rules of Professional Conduct," first published in 1957. These Rules are supplementary statements relating to the Canons of Ethics. No other organization has accepted these Rules, and there are many of them that are controversial and perhaps even contradictory. Despite this, their use was strongly advocated in NSPE's magazine, *American Engineer*, in an article by Stanley S. Paist, Jr., in October 1959.

In 1959 the Ethical Practices Committee of NSPE, under the chairmanship of Murray Wilson, of Salina, Kansas, inaugurated a program reminiscent of the old case history system of the American Association of Engineers. Actual cases are "tried" before this group and decisions rendered. The hope has been expressed that in time these will build up into a casebook of opinions that will be accepted by the profession.

The Functional Plan

The National Society of Professional Engineers would like to be the single spokesman for the whole profession in the field of ethics. This is brought out in its support of the "Functional" plan, first suggested by the Electricals, for engineering organization unity. Under this plan, Engineers Joint Council, as a federation of the Founder and other technical societies, would organizationally represent engineers in technical matters. Engineers Council for Professional Development would deal with matters pertaining to engineering education, while the National Society of Professional Engineers would represent the professional interests of engineers, which are understood to include legislation, registration, and ethics.

No matter what plan for unity, if any, eventually is developed, it is highly unlikely that the Civils will delegate responsibility for ethical matters to any other organization. Their ethical history goes back to their adoption of the 1914 code, and they never have shown any inclination to relinquish to others their right to censure or punish their own members. The other Founder Societies have more flexibility – but never all at the same time. Therefore, the delegation of all professional ethics matters to NSPE is not likely in the next decade.

More Codes by More Societies

The general adoption of the Canons did not, unhappily, signal a period of full agreement on a common code. The Consulting Engineers Council, a federation of state and regional associations of consulting engineers, formed in 1956, quickly came up with a code of ethics of its own. It claims for this code the advantages of brevity plus a positive approach telling the consulting engineer what he can do rather than what he cannot.

Several of the associations belonging to the Council have, in addition, their own codes of ethics adopted before they joined the Council. The Consulting Engineers Association of California, for example, is one of the many organizations formally subscribing to the Canons of Ethics; yet, as a member of Consulting Engineers Council, it also endorses CEC's code; and it has a code of its own.

A comparable situation exists within the National Society of Professional Engineers, an avid supporter of the Canons, which has some affiliated state societies that have independently endorsed the Canons while others have their own separate codes. The Ohio Society of Professional Engineers has left no approach uncovered. As an NSPE affiliate it subscribes to the Canons; it separately adopted the Canons itself; and it also has its own Code of Professional Practice.

The American Institute of Consulting Engineers seemed to feel the need of a new approach when, in 1958, it adopted a new code of ethics that much resembles the current code of the Civils. In addition, it approved a listing of 24 "Standards of Professional Conduct" as supplementary to its new code. And, it is to be recalled, the Institute had, itself, offered the "Singstad Draft" that became the Canons, in 1947, so its members should be fully guided ethically. If that is not enough, the Institute has as a requirement for membership, prior membership in one of the Founder Societies, so AICE members are further covered by the several codes of their Founder organizations.

The American Institute of Chemical Engineers, founded in 1908, might not have been let into the inner circle as a Founder Society until recently, but that did not prevent it from having its own code of ethics. A code was proposed in 1911, adopted in 1912, and finally incorporated in the constitution in 1928. AIChE was in on the development of the Canons almost from the beginning, being brought into the act as soon as ECPD adopted the committee left homeless by the death of the American Engineering Council. It was one of the constituent societies to "assent" to the Canons in 1947. Yet, like the Civils, it did not give up its own code, which today remains as Article VIII of the constitution of the Institute, as amended.

The Electricals, too, hesitated to give up their old code, even when adopting the Canons. They compromised. In adopting the Canons, they let these supersede their old code of 1912, but they could not bring themselves to give up the old entirely. In 1950, the directors adopted a "Statement of Principles of Professional Conduct," which contained the Canons, all right, but it also "supple-

mented them with certain rules of business from the old code not embodied in the Canons."

The Miners had no real problem. Of all the Founder Societies, they alone had no code of ethics. They adopted the Canons when asked to by ECPD, and left it go at that.

Engineers Joint Council, the federation of engineering societies that developed following the collapse of the American Engineering Council, did not involve itself in ethics until recently, leaving these matters strictly to the member organizations, as had its predecessor. But in 1957, its Task Committee on Consulting Practices prepared a piece on *The Practice of Consulting Engineering*. This manual had in it considerable advice on ethics, and it must be included in any listing of recently published ethical guidance material.

A comparison of this EJC report with a *Manual of Consulting Practice for Mechanical Engineers*, published a year earlier by ASME, leaves little doubt as to the inspiration for the EJC publication. They are almost identical except that the EJC version is rewritten to permit the recommendations to apply to consulting engineers in any branch of engineering. Also, a few errors have been corrected. The Mechanical Manual, for example, states that the Canons of Ethics forbids competitive bidding for engineering services on a price basis. This is not true (though many engineers think it is), and this statement has been corrected in the EJC version by the elimination of a paragraph.

The Civils Today

Strangely, the Civils, who were so severely criticized during the first quarter of this century for their lack of interest in ethics and for their refusal to enforce their 1914 code, now have become the most active of all the engineering organizations in ethical matters. The ASCE Committee on Professional Conduct stands almost alone among national engineering organizations in the regular handling of cases involving unprofessional activities, and several times in recent years it has publically expelled and suspended members for unethical activity. Such action has been rare since ASME, in the '30s, threw out a member named Parker and was promptly sued. ASME won the case but was harassed by Parker for years.

As a further indication of interest in professional ethics, the Civils adopted, in 1927, a long, rambling "Code of Practice" (as an addition to their code of ethics), and they amended their code of ethics twice between 1950 and 1960. Late in 1959 ASCE published a list of "Illustrative Interpretations." These explanations and examples were prepared by a Special Task Committee on Interpretation of the Code of Ethics. No sooner were these printed than there were committees put to work to recommend yet further changes in not only the interpretations but in the code itself.

It also should be noted that in 1957 ASCE approved yet another ethical item, this one formulated in an ASCE-AIA Joint Cooperative Committee, and known as "Interprofessional Principles of Practice for Architects and Engineers."

Knee-Deep in Codes

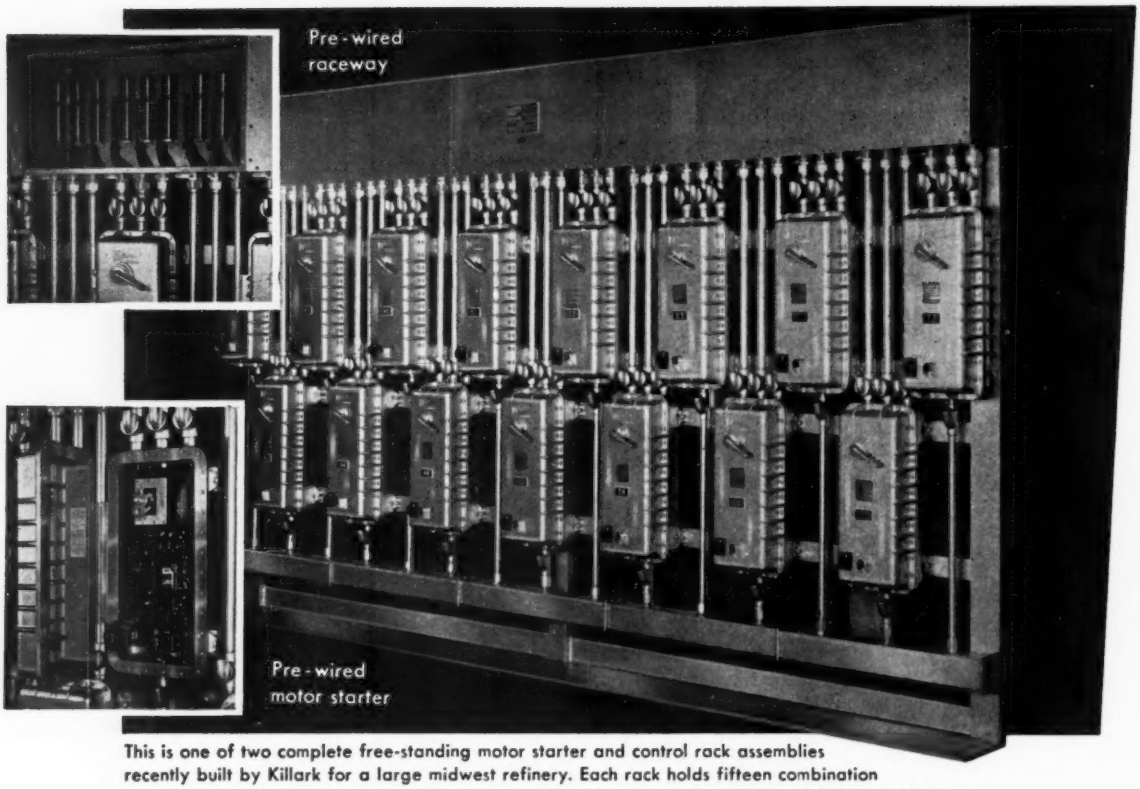
Now, half a century after the adoption of the first codes of ethics by the engineering societies, the engineer finds himself not lacking in guidance but instead nearly knee-deep in codes. If Christie was right in 1922, when he pointed out that the engineer who belonged to more than one society was frequently in a dilemma from conflicting rules, the engineer in 1960 finds the same difficulty but from many more directions. It looked for a while in the late '40s as though the Canons might be the answer to the need for a common code, but the 10 years following illustrated the inclination of each society to find just a few extra items that it felt its members needed. This brought about the new flood of rules, manuals, guides, and interpretations.

The various societies should not be too severely criticized for their little additions and explanations. The basic fault lies with Engineers Council for Professional Development for not suggesting and encouraging revisions of the Canons. That group's Ethics Committee developed the Canons and finally got them adopted by all the important societies, but that was about the end of it. The Canons now are treated as though they had been passed down in stone to some Moses or a committee of Moses's.

They become less interpretable each year as conditions of employment and practice in engineering change. This was expressed 40 years ago in an article, "Ethics and the Engineering Profession," by Morris Llewellyn Cooke, a consulting engineer of Philadelphia. He said, "The ethics or standards of conduct of any profession or group are very largely reflections in action of its ideals. The moment ideals become fixed or static they are dead. When we clothe a code of ethics as a guide to conduct with the quality of finality, it becomes as futile as sounding brass."

It is all well and good to have committees hearing cases and building up a common law of ethics, but a good set of opinions cannot be based upon outmoded statutes.

Just how much the Canons need revision is a matter of opinion, but some revision is certainly required. If it is not undertaken soon, the Canons, despite widespread acceptance, will be lost in the growing mass of resolutions, policy statements, and interpretations of the separate societies. ▲▲



This is one of two complete free-standing motor starter and control rack assemblies recently built by Killark for a large midwest refinery. Each rack holds fifteen combination motor starters. Both racks are completely pre-wired and pre-sealed according to latest provisions for installation in hazardous locations, and are joined by a pre-fabricated wireway. Adequate flanges have been allowed for mounting.

KILLARK CUSTOM-MADE SWITCH RACKS

Your worries are over from the moment you choose Killark custom-made switch racks because Killark provides a complete service—design to assembly. First, Killark prepares and submits a preliminary blueprint of the entire unit, drawn to your specifications. After approval, the switch rack is assembled, wired, and sealed *at the factory* by Killark workers with experience and equipment to do the job right. You receive a switch rack ready to install.

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Racks for indoor or outdoor, hazardous or non-hazardous areas. Write for complete literature.

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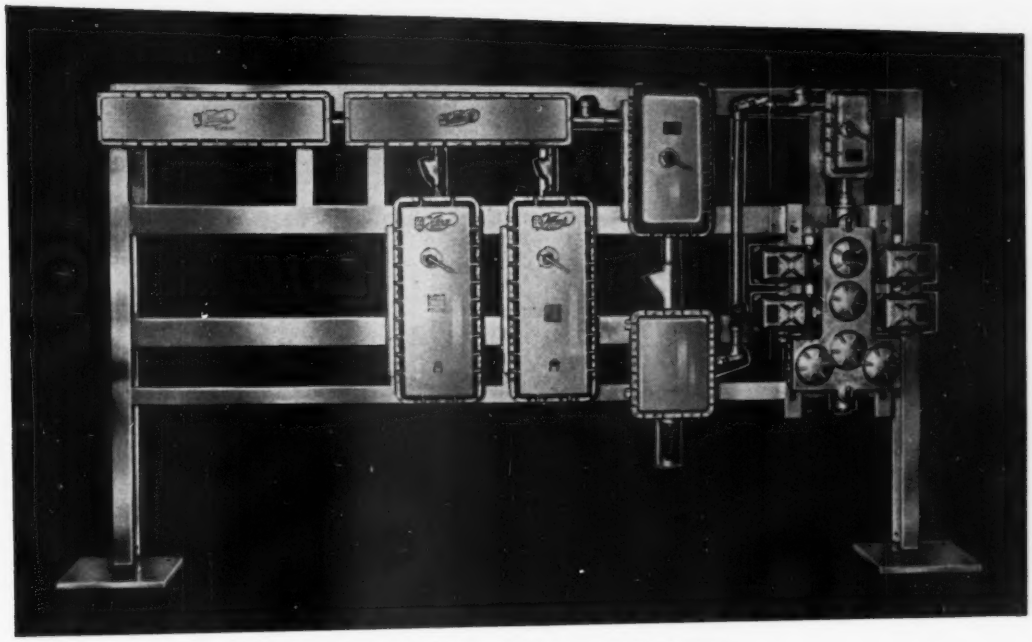


The flexibility and years of experience are Killark features that can readily be seen in this custom-made rack. Notice how open rack space and an extra gutter box have been provided for expected future expansion. Killark's rust-proof, non-sparking *aluminum* enclosures have been used throughout the assembly.

designed and built for your exact needs

CHECK THESE ADVANTAGES OF KILLARK CUSTOM-MADE RACKS:

✔ You get convenience because you work with one supplier, place one order, pay one price.

✔ You get dependable performance of Killark *aluminum* enclosures—circuit breakers, motor starters, disconnect switches, panel boards—all newly designed according to field tests and user surveys. Your aluminum enclosures are non-magnetic, non-corrosive, front operated. Rectangular shapes provide compact installation, easy maintenance. Components are ribbed for greater strength and faster heat dissipation which is so important to the accurate operation of thermal devices. Machined surfaces give tighter fit.

✔ You get the services of Killark engineers who are expert switch rack designers.

✔ You get a completely *integrated* unit. Components are of correct capacity.

✔ You get fast delivery. No delay awaiting parts from various suppliers.

✔ You get ease of installation. Your switch rack is ready to connect.

Next time you require a switch rack, investigate this new Killark service. You'll find that Killark custom-made switch racks can save you time, worry, and money.

6014

Killark supplies everything but the current!

On the Scene at Stockholm

DONALD QUICK
Special to CONSULTING ENGINEER

Consulting Engineers from fifteen countries meet to adopt business and ethics policies to guide the profession

- **More Members**
- **More Action**
- **More Money**

CONSULTING Engineers Council sent two delegates, Edward J. Wolff, of Chicago, and William W. Moore, of San Francisco, to Stockholm to represent U. S. consulting engineers at the Annual General Assembly of the International Federation of Consulting Engineers (FIDIC). One of the U. S. delegates, Ed Wolff, was invited to join FIDIC's newly expanded executive committee.

CE exclusive

The General Assembly itself and the executive committee meeting that followed dealt with a number of international policy statements to which all of the affiliated national groups are expected to adhere once they are approved by the Assembly. These policy statements involved advertising by consulting engineers, ethics and procedures of work in foreign countries, membership in member associations, the ethics of one engineer taking over the work of another for the same client, and the development of various standard types of agreement between engineers, clients, and contractors.

Money An Important Topic

Of considerable importance to the Consulting Engineers Council is the fact that the 1961 budget, as adopted, assesses the United States with dues equal to about 25 percent of FIDIC's total expenses – nearly ten times as much as the nominal 1960 U. S. dues. The proposed budget for 1961 adds up to 28,000 Swiss francs, or nearly $6500. This would mean that the U. S. would be expected to contribute about $1600, or, roughly $1 per CEC member. Put that way it does not sound like much money, but any increase of ten times is bound to hit hard. It does not take a seer to suggest that this will mean some fierce discussion at the next CEC meeting in Pittsburgh, and it will take some hard work on the part of avid FIDIC supporters to get CEC approval of this drastic dues increase.

The selling of this expanded FIDIC program to the Council will be the principal job facing delegates Wolff and Moore on their return from Stockholm. They must convince the Council directors that the private practice of engineering is not simply a local profession – that what consulting engineers do in other countries has an effect upon what consulting engineers do (and earn) in the United States. As delegate Bill Moore commented to this reporter in a fast-moving bus traveling down the left-hand side of a crowded Stockholm street, "Unless our boys realize the importance of this fast-growing international organization, we are likely to wind up behind the eight-ball."

The new dues schedule of FIDIC is the result of its increased activity. FIDIC officers are quite correct in pointing out that the principal criticism they had received in the past was that they failed to be active enough in representing their various

C. C. Parker - Canada. Johannes Rosenthal - Berlin

associations in international affairs. Lack of money, they point out, was the reason they could not always make the attitude of the profession known as fully as they would have liked. Now, they ask for the money needed to undertake the work waiting to be done, but they nervously await the barrage of criticism that will inevitably follow the announcement of increased dues. They are, it would appear, "damned if they do and then damned if they don't".

Membership Increase

FIDIC membership has increased 50 percent in a little more than a year. Up until 1959 there were 10 European member associations (Belgium, Denmark, Finland, France, Germany, Great Britain, The Netherlands, Norway, Switzerland, and Sweden), but this has now increased to 15 with the addition of the United States, Canada, South Africa, and Australia last year and the acceptance of Ireland as a member at this Stockholm meeting. As a result, the work of the secretariate, headed by Ing. H. Rusting, of The Netherlands, has increased enormously and has been forced to expand its staff in order that the work of FIDIC might be carried out with full efficiency and effect. This is where most of the increased budget will go.

Ed Wolff and Bill Moore attended this Stockholm Assembly with a directive from CEC instructing them to bind CEC in no way to an increased FIDIC assessment until CEC has had the opportunity to receive a detailed analysis of the financial proposals and approve them. This means that Wolff and Moore will be called upon to present a full report to CEC's executive committee and probably to the board of director's meeting in Pittsburgh that will explain exactly what FIDIC proposes to do with its new wealth.

At this Stockholm meeting, Wolff argued that there should be some limitation placed upon the percentage of income from any one national association. He cited CEC's own history in relation to the California Association, which several years ago found itself contributing all too high a percentage of total CEC dues. As a result, a maximum percentage for any association was set up. Wolff's attempt to have a similar maximum percent of revenue figure for FIDIC is to be decided by the executive committee, and it may be expected that a ruling will be shortly forthcoming. It is likely that this will be a 25 percent figure so that no one association will ever be required to contribute more than a quarter of the total.

Executive Committee Enlarged

Ed Wolff's invitation to serve on the FIDIC executive committee came about when this committee was increased in membership from six to eight. Last year at The Hague, the Assembly passed a resolution limiting the term of office of two of its members to just one year, the idea being that this executive committee might gain from frequent rotation of membership. However, this was found to be contrary to the FIDIC constitution which provides only for election to the board of directors for a period of four years. Therefore, this illegal action was rescinded and a resolution, presumably quite constitutional this time, was passed to increase the membership of the committee from six to eight. As a result, Wolff, of the Consulting Engineers Council, and Valter Furuskog, of Sweden, went onto the committee.

When the General Assembly debated a declaration of policy on personal advertising, the differ-

Edward J. Wolff and William W. Moore - U.S.A.

ence of approach in North America as opposed to most European countries became quite obvious. North Americans, both U. S. and Canada, find the considerably more cautious promotion approach claimed by European consultants somewhat unrealistic. Neither the U. S. nor the Canadian delegate could go along with the original wording of the FIDIC policy statement on personal advertising, and their views found support from, among others, France. The policy statement has been sent back to the executive committee for redrafting. The original statement took the basic position that all advertising should, as a matter of policy, be done for the profession by associations of consulting engineers rather than by individuals or individual firms. However, the wording that caused the most concern had to do with brochures being issued "to clients on request." This "on request" seemed to be going a bit too far, and certainly does not match current North American practice – nor does it match the practice in much of Europe.

Membership Classifications

Another policy declaration – this one approved – again brought forth the comments of the Council's delegates – but this time in agreement rather than in opposition. The declaration states that, "FIDIC considers that it is not in the best interest of any member association to accept as members-at-large or as associate members individual consulting engineers living in a country or state where no association exists qualifying for FIDIC membership . . ." This statement goes on to say that in such countries FIDIC would appoint a "correspondent" whose job it would be to attempt to form an association.

Council delegates had earlier expressed a desire for guidance on acceptance as CEC associate members engineers living in a foreign country such as Mexico or perhaps the Philippines. The policy statement does not preclude a consulting engineer from a FIDIC approved association becoming an associate member of another FIDIC approved association. This is common practice. The statement refers only to engineers in nonmember nations.

"Correspondents" who are consulting engineers of recognized stature and practice are appointed by FIDIC with the idea that they will attempt to set up associations in their own countries. Correspondents have been appointed in India and Iceland. FIDIC is looking for suitable consulting engineers in Greece and Italy.

No correspondent has been appointed in Japan, though two Japanese engineers attended the Stockholm Assembly as observers. FIDIC president Julian Tritton (Great Britain) invited them as members of a party of eight Japanese engineers currently touring Europe. There is no association currently in existence in Japan that would qualify for membership in FIDIC.

The FIDIC Assembly almost got itself tangled in a debate on the question of membership of engineering corporations in their national organizations. The policy statement declared it to be against the best interests of the profession to admit corporations to association membership. This, it was explained, did not in any way imply that consulting engineers should not practice as corporations where this was permitted by law, it merely meant that FIDIC felt that it should be an officer of the corporation, an engineer, who actually was a member of the national association rather than the "souless" and "unregisterable" corporation itself.

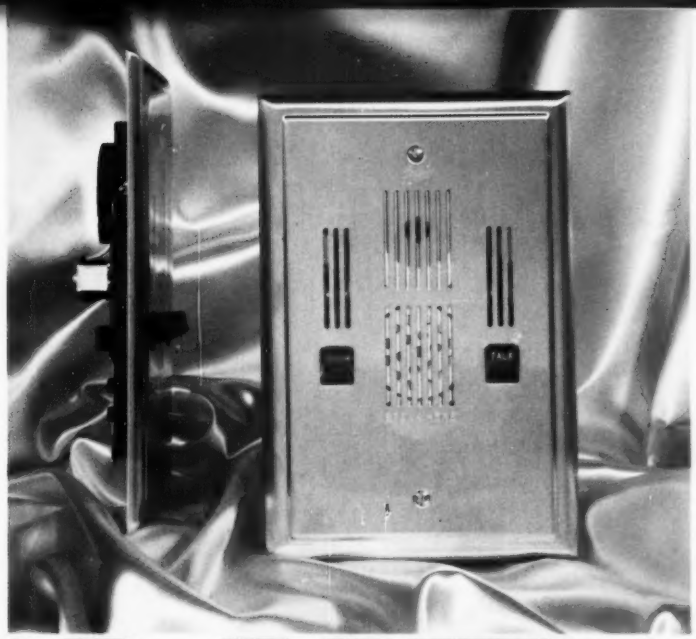
Another policy declaration frowned upon the admission to membership of a national association of a teacher of engineering who was also a consulting engineer, unless that teacher had his own engineering staff and an office away from the university or educational center in which he taught. However, no reference was made to "major source of income" or "principal" activity.

The General Assembly returned to the executive committee for redrafting a policy declaration relating to one consulting engineer taking over the work of another consulting engineer for the same client. While the statement proposed seemed to offer adequate ethical protection for the engineer being supplanted, the Assembly suggested that a broader wording be found that also protected the good client against what might be described as a less than ethical engineer.

Common Market Activity

FIDIC is to pursue its relations with the European Economic Community (the Common Market) through a subcommittee. It has also asked the Canadian delegate, Clarence Parker – immediate past president of the Association of Consulting Engineers of Canada – to cooperate with Consulting Engineer Council delegates in representing the North American point of view on the subcommittee on International Conditions of Contract for Works of Civil Engineering Construction. Work is continuing on the editing and revising of the International Conditions of Contract Between Client and Consulting Engineer and the International Conditions dealing with supply of Plant and Machinery.

There is no doubt that FIDIC seems to have caught fire and this enthusiasm may be able to light the way toward more international work and better international understanding for the whole profession. This is going to cost money, but for the United States, at $1 per member, the price seems reasonable. ▲▲



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A System For Every Size Building

Suite telephone has satin finish stainless steel faceplate . . . compact design to permit installation in buildings using shallow wall construction . . . removal of faceplate exposes all wiring terminals . . . wide choice of pushbuttons and signals . . . one of the units available in a complete line of equipment . . . including vestibule telephones . . . tilting mailboxes . . . directories . . . in standard modular units . . . to meet the requirements of any type or size apartment house.

Suite Telephone

LOCAL FIRE ALARM SYSTEMS

Meet Federal, State and Local Codes

Non-coded station features die-cast zinc case . . . rugged molded plastic housing . . . sealed mercury switch . . . selection of contact configurations . . . dual terminals for each contact . . . features typical of the complete line of modern Modular Fire Alarm systems . . . both coded and non-coded . . . all UL approved . . . with provision for use of vibrating horns and bells . . . automatic fire detection . . . and connection to city fire alarm system.

Non-Coded Station

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Proven Quality In Self-Contained Units

Selector desk telephone is key instrument in system consisting of from 2-20 telephones . . . where each station can be signaled individually . . . and as many as 10 simultaneous conversations may be held at one time . . . just one of many different systems available . . . for requirements ranging up to 200 stations . . . from simple selective ringing to selective-talking annunciator switchboard systems . . . all reflecting Couch's design for "simplified systems of communication".

Selector Desk Telephone

for complete details, write S. H. Couch Company, Inc. 3 ARLINGTON STREET NORTH QUINCY 71, MASS.

This comparative cost estimate (details are shown in the drawings and tables on pages 129 and 130) covers the upper level of an unusual underground structure. The framing has been designed to support a total superimposed load of 535 lbs/sq ft. Two other levels also were analyzed, and an economic conclusion was reached only after the designs for all levels were studied in the same manner. The most economical design in this cost comparison does not reflect upon the quality and economy of the materials used in the alternate designs. The cost estimates are relative in this instance only and are not typical for similar designs. Note that the unit prices include contractor's insurance, overhead, profit, and bond.

SUMMARY OF COSTS — UPPER LEVEL

Scheme	Unit Cost/Square Foot
I	$5.24
II	4.25
III	5.37
IV	4.50
V	4.46
VI	4.63
VII	4.27
VIII	4.36

Compare the Costs of Alternate Designs

HERBERT F. SHATZMAN, Supervising Engineer
Seelye, Stevenson, Value & Knecht

CE exclusive

THE DEVELOPMENT of new materials, improved construction methods, and better equipment has had a strong influence on the design methods and planning techniques used by consulting engineers. It has become essential to develop alternate designs, thereby making available several solutions to satisfy the requirements of a specific project. Only then can the selection of a particular design, material, or system be made at the proper time so that planning can continue in an efficient manner.

The comparative cost estimate is often the most effective means of evaluating different designs, methods, and materials, simply because it presents an organized and detailed study of the various items under consideration. The use of comparative cost estimates in consulting engineering practice can produce more economical and feasible designs, and can substantiate the final selection of the consultant in a conclusive manner.

As a basis for comparison, a typical condition usually is selected from each alternate design. This typical condition then becomes the basis for the entire cost analysis. The estimator must be sure, however, that each typical condition is an accurate and complete representation of its corresponding design. Obvious items which are an integral part of typical conditions and often overlooked include fireproofing of structural steel members, application of finish coats of paint, dewatering, relocation of existing facilities, provision of temporary services, and special safety precautions pertaining to hazardous operations.

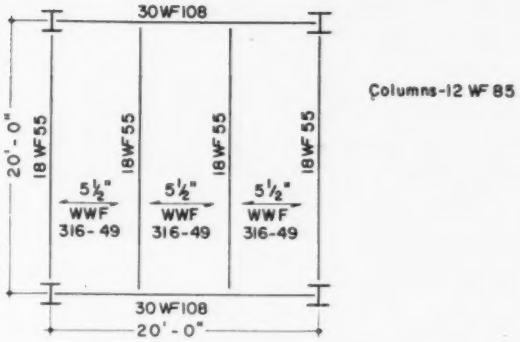
Since a comparative estimate will be of little practical value if it contains an incorrect quantity, a mathematical error, or even an unverified assumption, special care should be taken to insure that the quantity take-offs are accurate. The estimator should not assign unit prices to the estimated quantities for a typical condition until he has determined the nature and magnitude of each quantity item. For example, the estimator may be asked to analyze two structural framing designs for which typical conditions have been provided by the designer. We can presume that the estimator knows the location of the work, but he also must realize that the typical condition represents the structural framing for perhaps one of 15 floors, each with a total area of 8000 square feet. It may be argued that each typical condition is being analyzed on a purely relative basis, regardless of total quantity. However, it is important to remember that the total difference in cost of designs such as reinforced concrete and structural steel vary considerably between a 15-story building and a two-story building.

Related Costs

Comparative cost estimates should include all operating, maintenance, and replacement costs, especially when they involve pumping systems, elec-

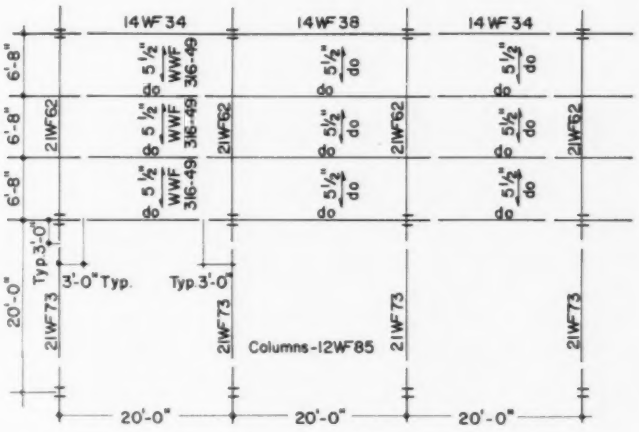
Scheme I
Steel frame & concrete slabs

Description	Quantity	Unit	Unit Price	Total Amount
Structural steel	6990	Lb.	$ 0.16	$1118.40
Slab formwork	400	S.F.	0.88	352.00
Wire mesh reinf. 3 x 16-4/9	400	S.F.	0.122	48.80
5½" Concrete slab	6.8	C.Y.	35.00	238.00
Sprayed on fireproofing	485	S.F.	0.70	339.50
Total	400	S.F.		$2096.70
Total	1	S.F.		$5.24



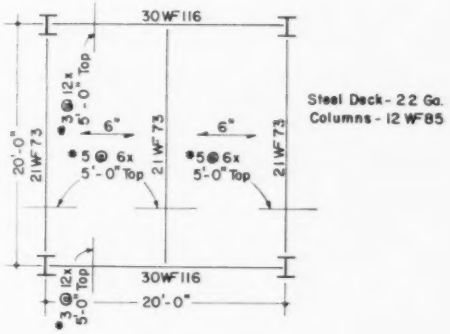
Scheme II
Cantilever steel frame & concrete slabs

Description	Quantity	Unit	Unit Price	Total Amount
Structural steel	4790	Lb.	$ 0.16	$ 766.40
Slab formwork	400	S.F.	0.88	352.00
Wire mesh reinf. 3 x 16-4/9	400	S.F.	0.122	48.80
5½" Concrete slab	6.8	C.Y.	35.00	238.00
Sprayed on fireproofing	420	S.F.	0.70	294.00
Total	400	S.F.		$1699.20
Total	1	S.F.		$4.25



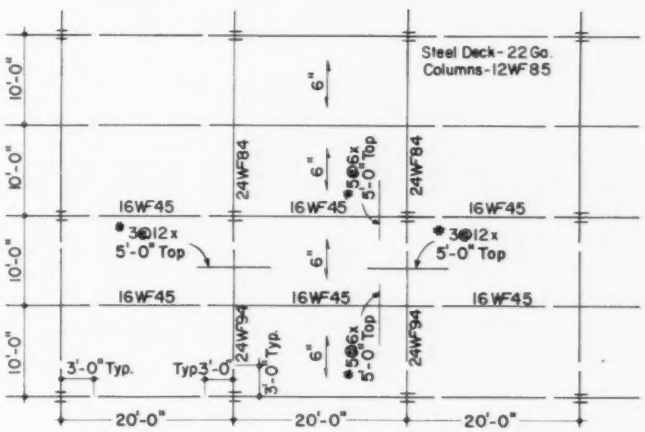
Scheme III
Steel frame, metal deck, & concrete slabs

Description	Quantity	Unit	Unit Price	Total Amount
Structural steel	6770	Lb.	$ 0.16	$1083.20
Steel deck, 22 ga.	400	S.F.	0.85	340.00
Timber shoring	320	B.F.	0.25	80.00
Reinforcing steel	460	Lb.	0.20	92.00
6" Concrete slab	7.4	C.Y.	35.00	259.00
Sprayed on fireproofing	422	S.F.	0.70	295.40
Total	400	S.F.		$2149.60
Total	1	S.F.		$5.37



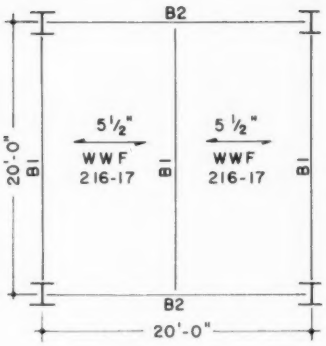
Scheme IV
Cantilever steel frame, metal deck, & concrete slabs

Description	Quantity	Unit	Unit Price	Total Amount
Structural steel	4800	Lb.	$ 0.16	$ 768.00
Steel deck, 22 ga.	400	S.F.	0.85	340.00
Timber shoring	320	B.F.	0.25	80.00
Reinforcing steel	460	Lb.	0.20	92.00
6" Concrete slab	7.4	C.Y.	35.00	259.00
Sprayed on fireproofing	373	S.F.	0.70	261.10
Total	400	S.F.		$1800.10
Total	1	S.F.		$4.50



Scheme V – Composite Construction: Steel frame & concrete slabs

Description	Quantity	Unit	Unit Price	Total Amount
Structural steel	4900	Lb.	$ 0.16	$ 784.00
Shear studs, ¾" x 2"	360	Ea.	0.35	126.00
Slab formwork	400	S.F.	0.88	352.00
Wire mesh reinf. 2 x 16-1/7	400	S.F.	0.28	112.00
5½" Concrete slab	6.8	C.Y.	35.00	238.00
Sprayed on fireproofing	246	S.F.	0.70	172.20
Total	400	S.F.		$1784.20
Total	1	S.F.		$4.46



Composite Construction

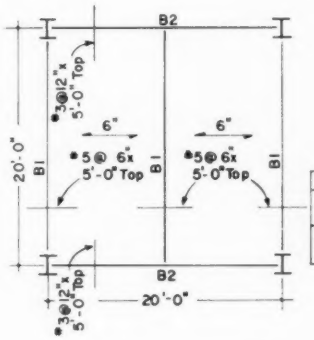
Concrete Slabs, Studs: ¾"ϕ x 2" Long (In Pairs), Cover Plates On Bottom Flange Only.

No.	Size	Studs Ea. End
B1	14WF30 PL6x1x17'-3"	5'-0"@3", 5'-0"@6"
B2	21WF62 PL10x1x16'-9"	@ 4" Full Length

Columns - 12 WF 85

Scheme VI – Composite Construction: Steel frame, metal deck, & concrete slabs

Description	Quantity	Unit	Unit Price	Total Amount
Structural steel	4900	Lb.	$ 0.16	$ 784.00
Shear studs, ¾" x 2"	360	Ea.	0.35	126.00
Steel deck, 22 ga.	400	S.F.	0.85	340.00
Timber shoring	320	B.F.	0.25	80.00
Reinforcing steel	460	Lb.	0.20	92.00
6" Concrete slab	7.4	C.Y.	35.00	259.00
Sprayed on fireproofing	246	S.F.	0.70	172.20
Total	400	S.F.		$1853.20
Total	1	S.F.		$4.63



Composite Construction

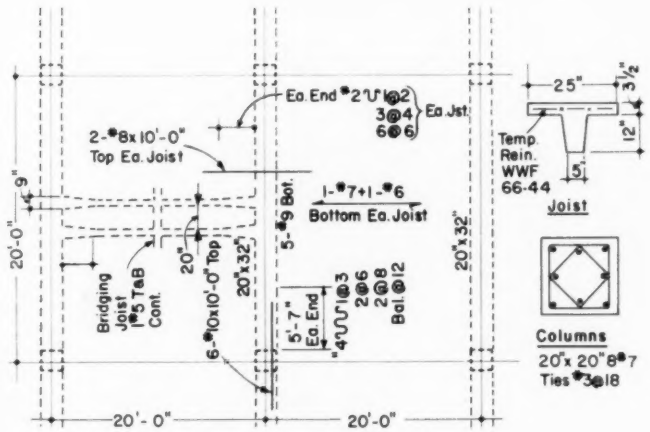
Steel Deck - 22 Ga
Studs: ¾"ϕ x 2" Long (In Pairs)

No.	Size	Studs Ea. End
B1	14WF30 PL6x1x17'-3"	5'-0"@3", 5'-0"@6"
B2	21WF62 PL10x1x16'-9"	@ 4" Full Length

Columns-12 WF85

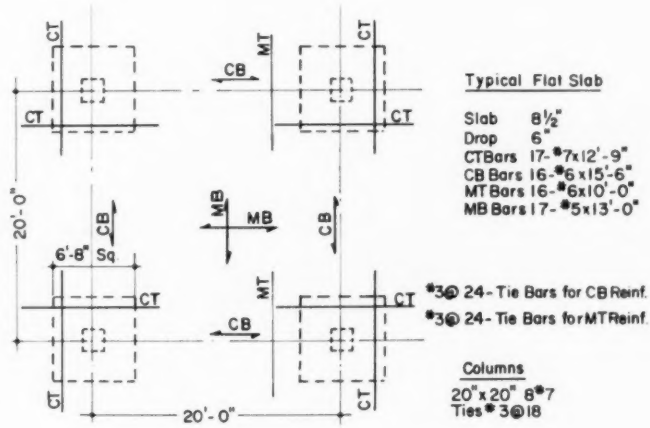
Scheme VII Concrete frame, one way ribbed joists

Description	Quantity	Unit	Unit Price	Total Amount
Metal pan forms	367	S.F.	$ 1.20	$ 440.40
Girder forms	83	S.F.	1.35	112.05
Column forms	103	S.F.	1.35	139.05
Reinforcing steel	2500	Lb.	0.20	500.00
Wire mesh reinf. 6x 6-4/4	400	S.F.	0.116	46.40
Concrete: Column	1.6	C.Y.	40.00	64.00
Slabs, ribs, and girder	11.3	C.Y.	36.00	406.80
Total	400	S.F.		$1708.70
Total	1	S.F.		$4.27



Scheme VIII Concrete frame, flat slabs

Description	Quantity	Unit	Unit Price	Total Amount
Flat slab forms	400	S.F.	$ 1.25	$ 500.00
Drop edge forms	14	S.F.	1.25	17.50
Column forms	112	S.F.	1.35	151.20
Reinforcing steel	2990	Lb.	0.20	598.00
Concrete: Column	1.7	C.Y.	40.00	68.00
Slab incl. drop	11.4	C.Y.	36.00	410.40
Total	400	S.F.		$1745.10
Total	1	S.F.		$4.36



Typical Flat Slab

Slab 8½"
Drop 6"
CT Bars 17-*7x12'-9"
CB Bars 16-*6x15'-6"
MT Bars 16-*6x10'-0"
MB Bars 17-*5x13'-0"

*3@ 24-Tie Bars for CB Reinf.
*3@ 24-Tie Bars for MT Reinf.

Columns
20"x20" 8*7
Ties *3@18

trical and fuel distribution systems, and paint systems. For example, in a recent cost comparison of a sanitary sewerage pumping system and a gravity system, a number of items were added to the estimate for the pumping system, based upon the anticipated life of the installation. These included the cost of a spare pump, an emergency source of power supply, standard power supply, regular maintenance, emergency repairs, and replacement. Regardless of the result of this cost analysis, the omission of these factors would have presented an unrealistic condition to the client. However, comparative cost estimates should not be evaluated solely on a monetary basis, for the most economical scheme is not always the most desirable one.

In situations where funding is limited and the respective costs do not differ appreciably, a further investigation of the nature of the work is mandatory. A careful study should be made of problems arising from adjustment of existing facilities, real estate and legal restrictions, future expansion, and construction methods.

Construction Site Factors

Demolition work, road and utility relocations, interruption of services, and provision of temporary services are all expensive operations which must be performed frequently in order to accommodate new work. They may be objectionable due to limited work areas, conflict with local ordinances, objection of residents, and political pressure. In addition, clients will be more inclined to spend money directly for new construction rather than have a sizeable amount of their funds used for extensive removal and relocation operations. On a comparative cost study for a proposed airport improvement, one alternate design included a four-lane road relocation, a new river crossing, and electrical power line relocation. This work amounted to 21 percent of the total cost of the improvement, but the design still compared favorably with another scheme which required even more extensive relocation work. The final selection was made on the basis of a design offering the most construction along with the least objectionable relocation work.

Acquisition of new property, existing property limitations, and building codes and ordinances may influence the feasibility of a particular design selection. Consider the situation of a company faced with the following alternates in an effort to expand its plant facilities.

¶ Occupy Site X which is presently owned by the company. Site X is located in an area requiring expensive site development.

¶ Purchase Site Y which is located in another city. Site Y is very desirable in view of its adaptability for new construction with a minimum of cost for site improvement. The owners of Site Y realize its value and will not sell cheaply.

After comparing these alternatives the consulting engineer finds that both sites are equally expensive. However, the building codes and ordinances that govern Site Y are very strict, and a more expensive plant building will be required in order to conform with them. The choice of Site X has been dictated by code requirements.

Prebuild or Defer?

Certain designs may be more readily adaptable for future expansion, thereby justifying a greater initial expenditure. This advantage should be considered carefully. For example, completion of such work as dredging, rock excavation, and heavy earthmoving can be done in one continuous operation rather than in several stage increments. A large initial investment in plant equipment is required for this type of construction and a considerable amount of money can be saved by consolidating the operation.

In one instance, a client wanted to divide the construction of land improvements for his municipality into three phases, each phase containing approximately 350,000 cubic yards of hydraulic fill. The hydraulic fill was to be deposited by means of dredging operations. The estimated cost of each phase was $245,000 or $0.70 per cubic yard. The combined cost of all three phases would then be $735,000, assuming that the unit price of dredging is maintained. If the hydraulic fill were to be placed in a single, continuous operation, the total cost would be $420,000, or 1,050,000 cubic yards at $0.40 per cubic yard – net saving of $315,000.

Similar savings can result from constructing future underground line extensions before pavement is put in place, in order to avoid eventual removal and replacement. This item is of psychological value as well as good engineering sense. Clients do not look kindly upon the prospect of removing newly completed construction in order to accommodate future extensions which easily could have been provided for in a previous contract.

Special construction techniques may be required for projects such as intricate radar detection systems and complex missile launching shelters. The ultimate cost of this type of work will depend upon the resourcefulness of the contractor. The cost of special construction methods should be considered only in comparative estimates for work in remote areas and under extremely difficult conditions.

Objectivity Required

During the preparation of comparative cost estimates the estimator may evolve other economical schemes which offer new ideas to the project plan-

ner, thus utilizing the estimator's experience with materials, methods, and their respective costs. However, the estimator should always maintain his objectivity by evaluating, presenting, and analyzing cost estimates strictly on the basis of their relative performance. The integrity of the estimator is the real foundation of every cost analysis. Each cost comparison should be approached with an open mind, regardless of the estimator's personal opinion concerning the suitability of individual designs, materials, and methods.

Comparative cost estimates should be presented to clients in an orderly manner using charts or tabular forms wherever possible. Clients and reviewing agencies usually prefer to read itemized comparisons rather than lengthy explanatory texts. Graphical illustrations of various structural designs for a floor system can be understood more readily than lengthy descriptions of the design criteria.

It is important to prepare comparative analyses for alternate designs, regardless of their respective costs. A complete analysis will serve to justify the final selection in a more conclusive manner. The estimator may offer his opinion regarding what he feels is the most desirable selection, but his presentation of all the facts should be sufficiently clear so that clients or reviewing agencies will be able to draw their own conclusions.

Clients should be cautioned concerning the application of comparative cost analyses to conditions for which they were not intended. Each analysis is based upon a specific design, and the result is not automatically transferable to similar work. This type of generalization is dangerous and should be discouraged. It is worthwhile to remember that the relative costs of structural designs for a single building will vary greatly with increased or decreased column spacings, floor loadings, and code requirements.

Each Project Demands Careful Study

Considerable time and effort should be devoted to the preparation of alternate designs and their corresponding comparative cost estimates, for they are an integral part of the planning operation. The analysis of comparative cost estimates is regarded too often as an automatic procedure, much to the disadvantage of all concerned. A legitimate effort deserves a sincere evaluation in order to serve the best interests of the job and the client. Comparative cost estimates can prove to be very valuable when they are prepared and analyzed with fairness and accuracy. However, their real benefit lies in the economy that is passed on to clients as a result of a small additional investment on the part of the consulting engineer. ▲▲

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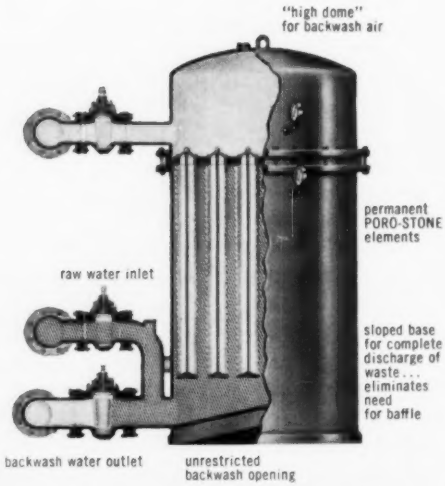
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FIELD ENGINEERING SERVICE is available to architects and consulting engineers through more than 100 Square D offices, backed by over 1000 authorized electrical distributors and 19 plants in the United States, Canada, Mexico and Great Britain

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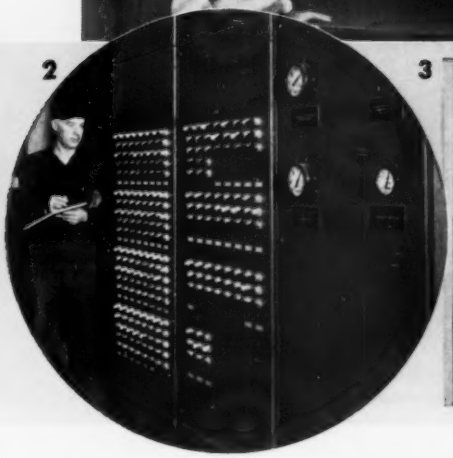
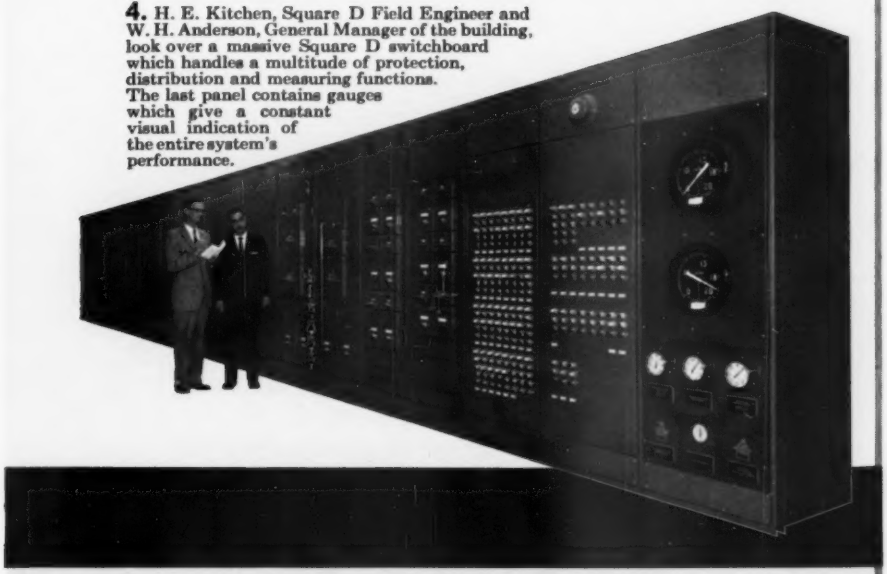
1. Nando Arduini, Resident Engineer, inspecting the Square D equipment in one of the electrical rooms. There is an identical room on each floor. Each has three Square D lighting and power panelboards, fed by Square D duct.

2. This Square D control panel, installed in the boiler room on the 26th floor, is a duplicate of that in the basement main switchboard. It provides another point from which the entire heating and air conditioning systems can be controlled.

3. These two Square D wall-mounted panelboards contain over-current protective devices for each of the automatic elevator controllers.



4. H. E. Kitchen, Square D Field Engineer and W. H. Anderson, General Manager of the building, look over a massive Square D switchboard which handles a multitude of protection, distribution and measuring functions. The last panel contains gauges which give a constant visual indication of the entire system's performance.



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NSPE At Boston . . .

Discussions on Unity
Reports on Ethics Cases
Functional Section Activities

AT THE National Society of Professional Engineers annual meeting in Boston recently, it was announced that NSPE, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers are going ahead with the Functional Plan for Unity . . . hoping that the other societies and Engineers Joint Council will follow. (ASME denies that there is anything official or final about this on its part.)

Position of Technical Societies

Action taken by NSPE was a direct result of similar action taken at an ASME convention in Dallas shortly before. ASME indicated that it still wants NSPE to join EJC, but it evidently has faced the fact that this is unlikely. For the Electricals, this is no new decision. Several years ago AIEE voted to implement the Functional Plan itself when and if possible.

In addition to ASME and AIEE, the American Institute of Mining, Metallurgical, and Petroleum Engineers and the American Society of Civil Engineers had observers at the NSPE meeting.

The Miners were asked about their attitude toward the Functional Plan at this time. The representative replied that "few AIME members know what the Functional Plan is, some do not even know what EJC is, and the problem is going to be one of communications first."

Frank Marston, ASCE president, put in another plea for NSPE to join EJC, and he reinterated the advantages of unity through an already existing organization—EJC. He pointed out that this plan for unity would take away none of the traditional activities of any organization taking part.

Survey Supports Registration

What about NSPE allowing nonregistered persons to join? This would be almost a necessity in implementing the Functional Plan. A recently completed survey (with questions worded so as to leave little doubt of the answers desired) found that two out of three NSPE members prefer unity through the Functional Plan. The same survey showed that NSPE members do not favor letting down the bars to nonregistered members. However, NSPE took no strong stand on this at the Boston meeting.

Harold Foote, president of AIEE, pointed out that the Electricals indicated long ago that they hope NSPE will allow all AIEE members to join, at least for a limited time, so the requirement could be made that all future AIEE members be registered. However, he stressed that AIEE cooperation on the Functional Plan is not conditional in any manner. William Ryan, former ASME president, indicated that his organization feels much the same way.

The AIME representative said there is the possibility that AIME would change its membership requirements in the future to require all members to be registered. However, he said the registration examinations would be somewhat of a problem, pointing out that it is easier for a metallurgical engineer to pass a test on pure science than a test on structural, mechanical, and electrical engineering.

The entire discussion on unity was short and caused little comment among NSPE members attending the convention.

Also along unity lines, NSPE passed a resolution suggesting that Engineers Council for Professional Development undertake to coordinate the work of education committees of NSPE, the Founder Societies, and all other technical groups. It was pointed out that, ECPD always has devoted most of its time to accreditation of engineering curricula.

Ethics Cases

The Board of Ethical Review released two more cases, one showing how to write an ethical press release and the other finding that it is all right for a consulting engineer to bid on subprofessional services:

"Question – Does the issuance of press releases by or for the consulting firm constitute advertising of a self-laudatory nature, proscribed by Section 2 of the Canons of Ethics?

"Discussion – Whether issued by the firm itself, or on its behalf by a public relations firm, the press release is advertising in the sense that its purpose is to make known to other persons the engagement of the firm, with the resulting inference that the dissemination of such knowledge may generate additional engagements."

The following, according to the Board of Ethical Review, is a good press release:

"On petition by Herman T. Stitchman, trustee, Federal Judge Archie O. Dawson authorized on December 29 the retention of the New York engineering and management consultant firm of Doe and Roe, for a study of the present-day value of the railroad properties

NEW

MULTI-ZONE

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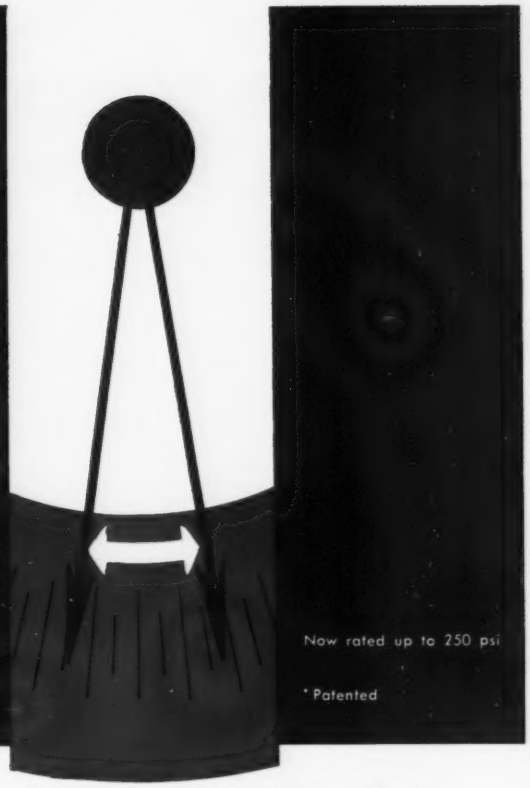
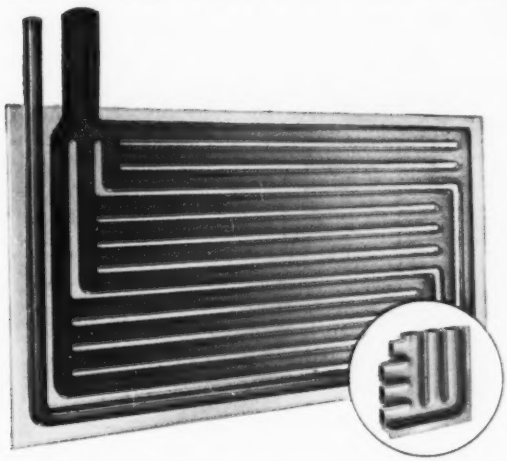
FASTER START-UP, CONSTANT TEMPERATURES



The new MULTI-ZONE design cuts "downtime" and compensates for intermittent overload in a wide range of tank and process heating applications. Multiple headers and multiple condensate returns provide for FREE-FLO action — with practically instantaneous distribution of steam to all levels of the plate. Condensate "trapping" is held to a minimum. This gives the new MULTI-ZONE PLATECOIL a reserve capacity to deliver under overload conditions during "start-up." It also produces extremely fast recovery of tank temperature with minimum variation.

IN ALL KINDS OF TANK AND PROCESS HEATING



Operating Pressures up to 250 psi — DURAWELD bonding of the plates and mill-controlled TRANSTEEL in standard units have boosted PLATECOIL pressure containment rating up to 250 psi. This makes the time-proven advantages of PLATECOIL applicable to many types of heating where 250 lb. steam is required. Destruction tests have demonstrated a safety factor of 5 to 1.

Low Installation and Maintenance Costs. — PLATECOIL costs are low compared to the cost of engineering, fabricating, installing and maintaining pipe coils. Lightweight, compact PLATECOIL simplify installation. Greater heat transfer per sq. ft. of surface permits smaller units which save valuable tank space. Streamlined surfaces cut cleaning costs. Integral, factory fabricated construction eliminates threaded joints (in the solution) to corrode or leak. All stainless steel and alloy PLATECOIL units affected by cold working are annealed and pickled after fabrication to return the metal to its original condition and thus eliminate the probability of corrosion due to internal stresses and carbide precipitation.

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WORLD'S HIGHEST SINGLE LIFT LOCK FEATURES Servisafe POLES

Floating guard boom and lock (background) at T. V. A.'s Wilson Dam, Florence, Alabama

EASE OF LUMINAIRE MAINTENANCE ASSURES YEAR-ROUND LIGHTING EFFICIENCY FOR GIANT NEW LOCK AT WILSON DAM

To expedite barge traffic through Wilson Dam, a new 110 x 600 foot single lift lock has been installed by the Tennessee Valley Authority. This giant lock, capable of handling an entire tow in a single lockage, will operate around-the-clock. A high level of illumination is required therefore for night operations. In addition, lighting efficiency must be maintained year-round. Thompson "Servisafe" Poles met the specification for this job and 80 units were installed along the lock, its floating guard boom and a new steel bridge over the lock.

"Servisafe" poles permit fast, safe, all-weather luminaire servicing *at ground level.* They also reduce maintenance costs because a single unskilled man can quickly relamp and clean a pole-mounted light without hazard or costly auxiliary equipment.

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T-E

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and business of the bankrupt Hudson & Manhattan Railroad Co.

"Doe and Roe, which is located at....., is a 65-year-old firm. It has long been active in the fields of mass transportation and property valuations."

(The last paragraph was defined as the absolute limit beyond which a firm could not ethically go.)

The following release is not acceptable under ethics rules:

"Joe Doe Associates, architect-engineer, has set up a Government Department to be headquartered in the firm's own two-story building here. At the same time, a new office to service this department was opened in Washington, D. C.

"We are investing 34 years of experience," Mr. Roe said, "in a massive program to spur development of quality building for budget-conscious government agencies.

"The firm is a complete architect-engineer organization with a staff of over 100, geared to handle large projects efficiently on tight time schedules. This is an extremely important aspect of government construction work, particularly for military work. Facilities available to the staff are designed for the most efficient flow of architectural production.

"Since its organization, John Doe Associates, according to Mr. Roe, has planned, designed, and supervised the construction of over 400 different projects including industrial and public buildings, schools, churches, hospitals, housing, recreational facilities and urban redevelopment. Many of these projects were accomplished on minimum budgets and tight time schedules."

The Board of Ethical Review said "we would add, as a general cautionary note, that consulting firms should insist upon review and clearance of the content of all press releases of the type discussed in this opinion. Such vigilance should preclude exaggerated, untrue, or misleading claims or statements which otherwise might result from the zeal of the public rela-

Trowel points to Wide Flange Rapid Control Joint, a companion product used with Dur-o-wal

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More and more, architects and engineers are specifying this combination to assure permanent masonry wall construction.

Dur-o-wal Reinforcement, fabricated from high tensile steel with deformed rods, lays straight in the mortar joints with all of the steel in tension and working together as a truss. This is the basic engineering principle that makes for maximum flexural strength.

And the Rapid Control Joint, with its wide neoprene flanges, automatically assures the flexibility that lets a wall "breathe" under various natural stresses, provides a tight weather seal with minimum caulking.

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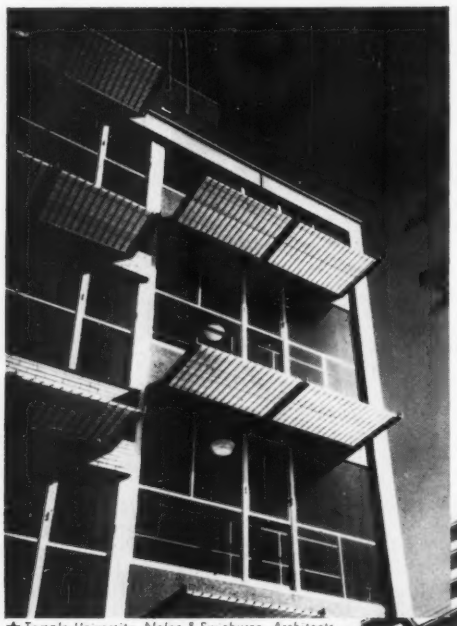

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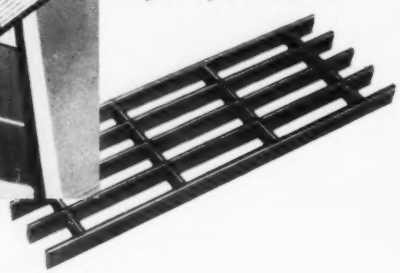
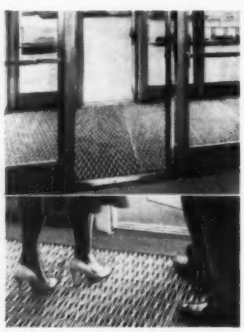


★ Temple University, Nolen & Swinburne, Architects

SUNSHADES

of standard panels of Irvico aluminum grating reduce cooling costs and add handsome "transparent" appearance to this four-story classroom building. The open mesh won't trap hot air next to glass. Grating panels are strong enough to be used as window cleaning walkways. They provide a permanent, practical solution to the problem of sun control.



VESTIBULE MATS

Dirt and slush drop through open-mesh grating into receptacles below then are flushed into sewers, preserving interior cleanliness.

IRVICO

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tions firm to serve the interests of its client."

The second case discussed what a consulting engineer who offers subprofessional services in addition to his engineering should do if asked to submit a bid on the subprofessional work.

"It is desirable where the subprofessional work is a large part of the firm's activities, to operate through a separate form of organization, with a distinct name. Where this is not practicable, and in the case of an operation in both categories by the same firm, the engineer should adopt other means to segregate the types of work, including references in the contract or in correspondence.

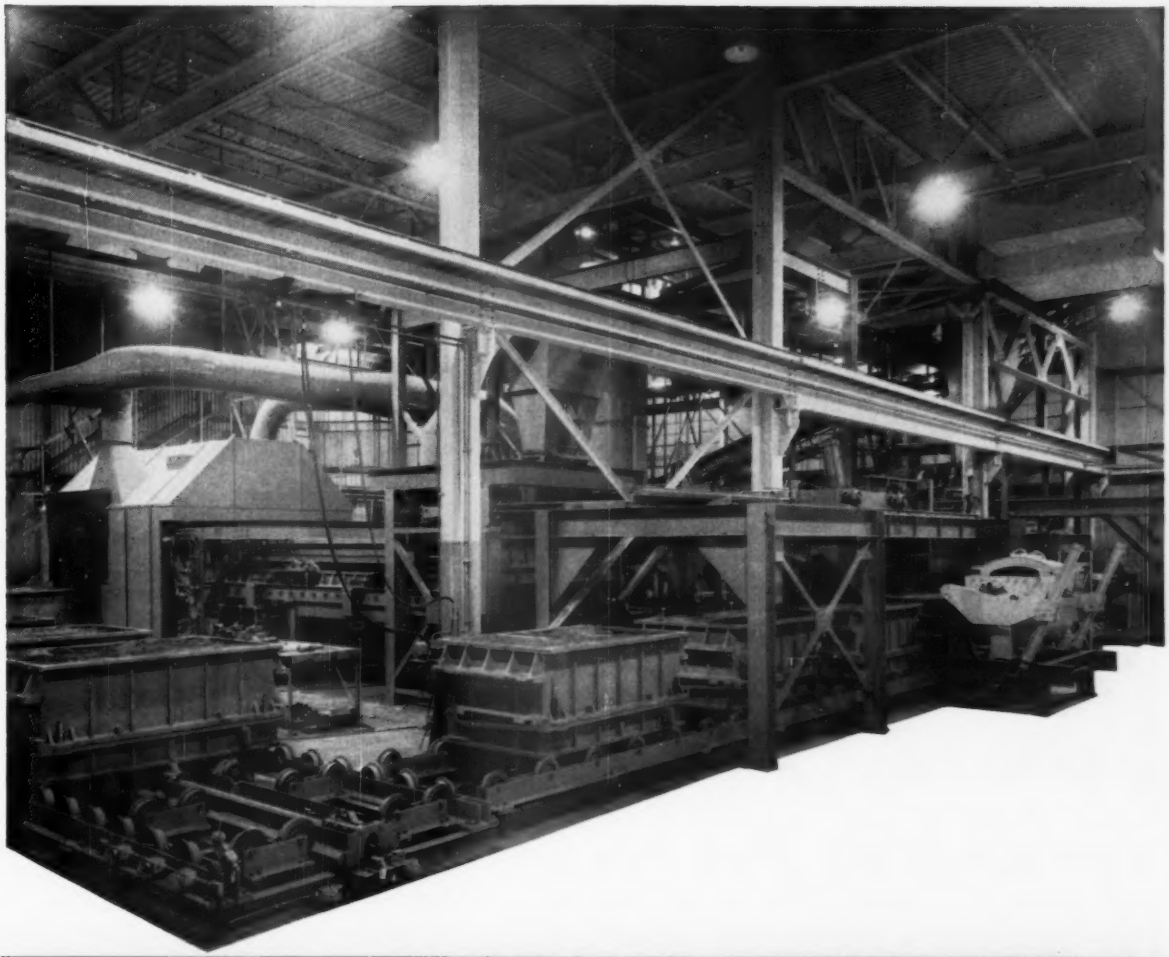
"In applying the distinction noted above, it should be kept in mind that the prohibition against competitive bidding for professional services is based on protection of the public through avoidance of the sacrifice of quality to the lowest price. This principle is not applicable to subprofessional or nonprofessional services, and this difference permits competitive bidding for subprofessional or nonprofessional (business or commercial) services, which may be clearly and accurately specified."

A new ethics rule also was presented to the NSPE board. It reads as follows:

"While in the employ of others, he will not enter into promotional efforts or negotiations for work or make arrangements for other employment as a principal or to practice in connection with a specific project for which he has gained particular and specialized knowledge without the consent of all interested parties."

Functional Section Meetings

An entire day was devoted to meetings of the various Functional Sections. Highlight of the Functional Section meeting for Engineers in Private Practice was the speech of Congressman Gordon H. Scherer favoring participation of consult-



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NEW AUTOMATIC MOLD HANDLING SYSTEM

PRODUCES SEVENTY-TWO 14,000-LB. MOLDS PER HOUR

This new automatic bathtub mold handling system is one of the largest and most advanced systems in existence. The system has a capacity to turn out seventy-two 14,000-pound molds (includes flasks, sand and casting) per hour and requires only seven operators.

Engineered and fabricated by Planet Corporation and installed in Universal Rundle Corporation's Camden, New Jersey, foundry, this new automatic bathtub mold handling system has achieved several "firsts." They are:

- First to be completely shuttle-indexed.
- First to use weights rather than clamps.
- First to incorporate automatic sand metering.
- First to index flasks through shakeout.

Custom designed systems such as this have helped build Planet Corporation's reputation throughout industry as a versatile organization . . . as an organization with solutions to the most perplexing materials handling and automation problems. Let Planet demonstrate how "PV" —Planet Versatility—can help you solve your problems . . . you'll find it pays to plan with Planet.

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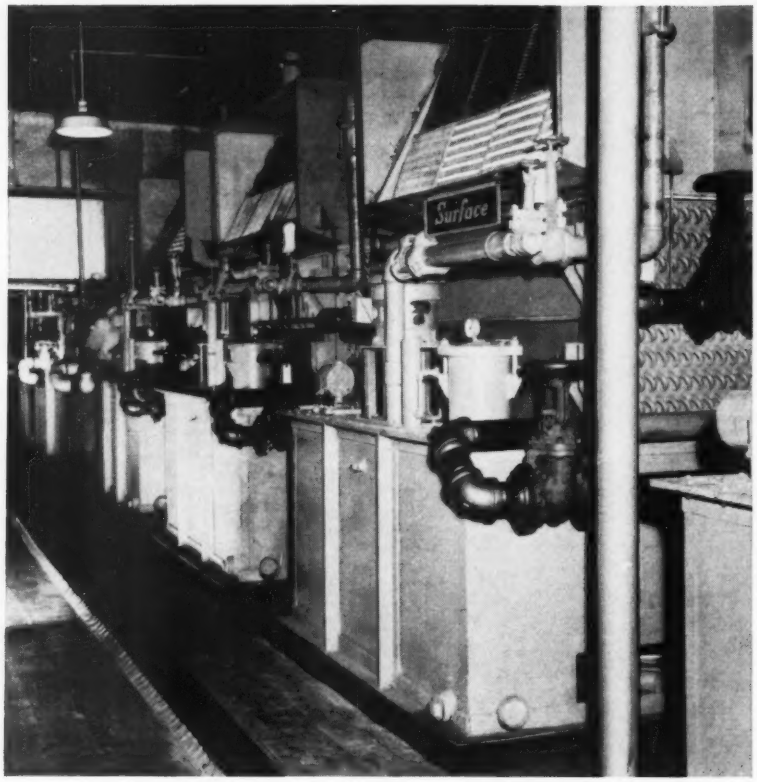

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Without Kathabar, this job would have taken 1800 tons of refrigeration, at about 35F and reheating air from about 45F to 98F! With Kathabar the job took 6 hp instead of 2000. Ask the men who have seen Kathabar Type C units serve for years with practically no maintenance. Write for specific information.

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ing engineers in the highway program (see page 148).

L. M. Van Doren, new chairman of the Functional Section, told of the activities of the Kansas Section and why they are a Functional Section of NSPE rather than affiliated with Consulting Engineers Council. "My partners and I pay dues of $3000 a year to the Functional Section. We are businessmen, and we would not pay this unless we thought we were getting something for our money. If we thought Consulting Engineers Council would offer us more, we would be CEC members."

Van Doren said the Kansas group has used funds primarily to gather facts before taking action. Unauthorized practice has been virtually eliminated in Kansas through this program, with the attorney general issuing 19 injunctions. The Section also keeps a close eye on the ethics of Kansas consultants, which has prevented many cases from developing.

What about telephone listings? "We did not find this a difficult problem. Actually, we practically rewrote the Wichita directory."

Van Doren said too many people have a tendency to write Washington when they have a problem. Most problems could be settled better at home.

Positive Approach

The Kansas Functional Section also is gathering further data on costs of public vs. private highway engineering. After Kansas highway officials said they could do engineering cheaper than could consulting engineers, the Functional Section got permission to have a CPA examine the highway department records. Part of the agreement is that the findings will not be made public. "We all want to get this hassle out of the newspapers." Van Doren said both the consulting engineers and the Kansas highway department engineers merely want to know the truth. (Maybe the public would like to

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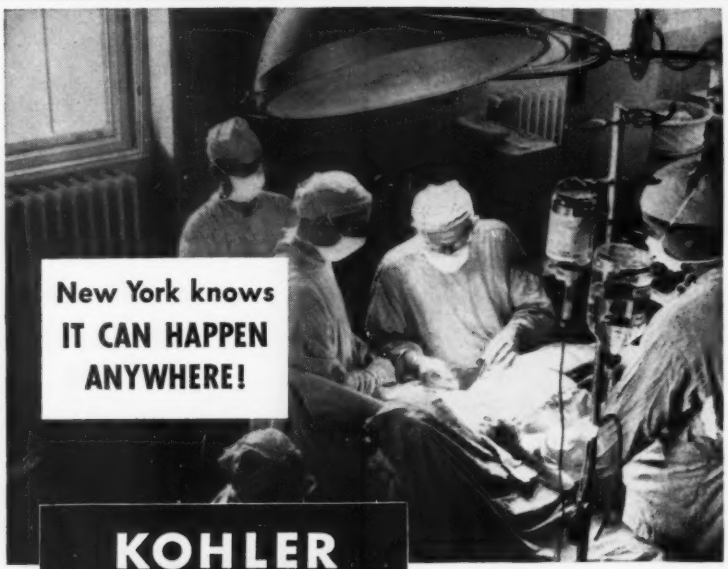

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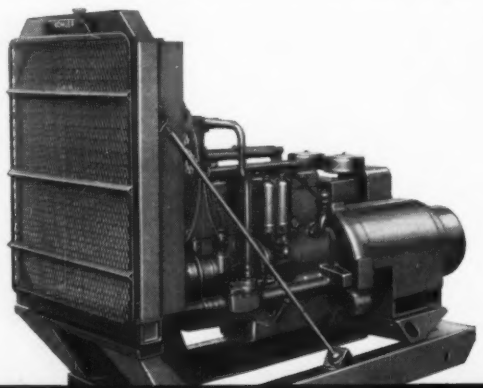
Kohler electric plants are reliable, easy to install for emergency power made vitally important by today's increasing dependence on electrical equipment. To help you write specifications for varied applications Kohler Co. will send on request a manual with complete data on sizes from 1000 watts to 100 KW, gasoline or diesel. Write Dept. G-68.



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know, too — it is tax money that is being spent.)

McCamy Case Report

Arthur Lewis, the defense attorney in the McCamy case in New Jersey, discussed the importance of the case as a precedent. In the McCamy case, an engineer is accused of practicing architecture in the design of a country club and of a house. The case is scheduled to resume on June 27, at which time Lewis plans to present a 20-point motion for dismissal. He said it is a foregone conclusion that whatever happens, there will be an appeal.

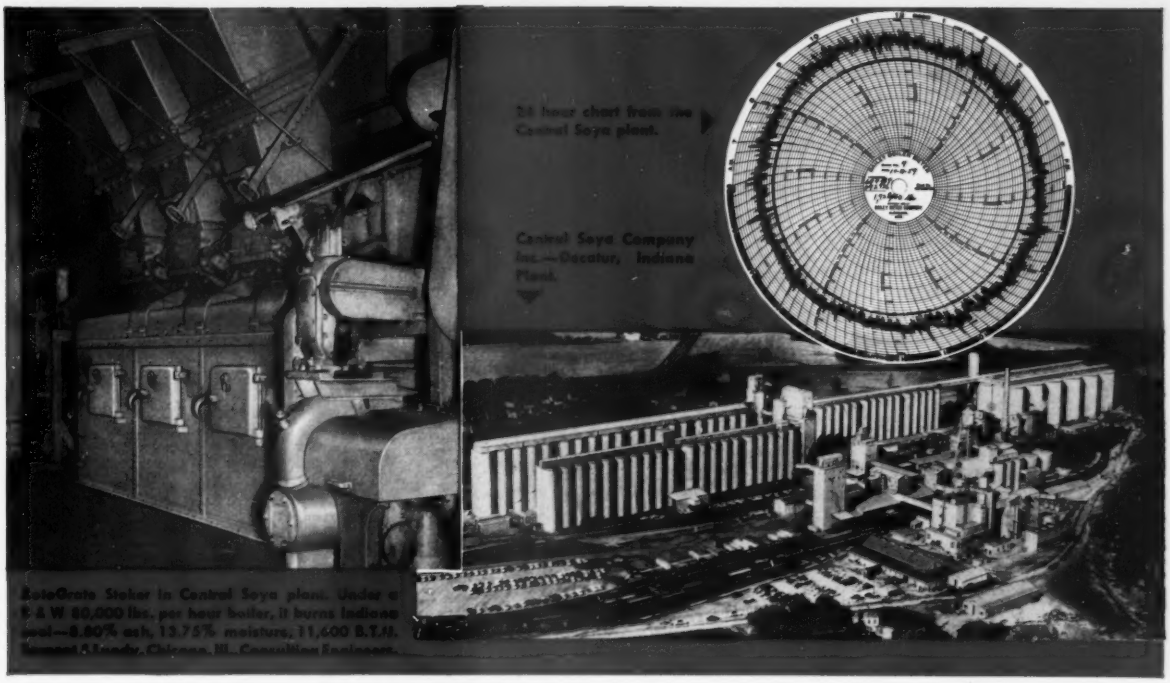
The architects are trying to reserve for themselves the design of all inhabited space. Lewis said that if this happens, engineers would be left with the design of sewers, refrigerators, generators, bridges, and the like.

Other Actions

It also was announced during the meeting that NSPE has scheduled a meeting in the near future with representatives of American Telephone & Telegraph Co. to make another try at cleaning up engineering listings on a nationwide basis. It was pointed out that one trouble in the past has been that NSPE members could not agree as to what is wanted from the telephone company.

The Engineers in Government Functional Section also is making a survey that will be of interest to consulting engineers:

"It is planned that the report (a survey) will contain information and data relating to the size of engineering staffs among various state departments and agencies; the percentage of registered engineers; the number and ratio of supporting technical personnel; qualifications and requirements for certain engineering jobs such as education, experience, registration, etc.; and information on occupational titles and grade levels of engineering employees." ▲▲



8 Years of Stoker Operation
Without Forced Outage

DETROIT ROTOGRATE AVAILABILITY AT CENTRAL SOYA COMPANY INC.

Hersel Nash, Steam Power Superintendent of Central Soya Company, Inc., Decatur, Indiana Plant says: "Our 80,000 pounds per hour, 600 psig boiler with Detroit RotoGrate Stoker has carried loads similar to the accompanying chart for 355 days per year for eight years (we have the boiler down for inspection and cleaning once each year, for about 10 days.)"

"During this time we have burned about 300,000 tons of Indiana coal without ever losing the load because of the stoker. Our monthly efficiencies average 85% to 86%. This is above the manufacturer's predicted performance."

This 'round the clock—seven days a week operation year in and year out with high economy proves the rugged stamina and ability of the RotoGrate . . . shows why it has long been first choice among operators and top management alike.

Built to serve steam generators up to approximately 400,000 pounds steam per hour capacity, the RotoGrate is one in a complete line of Detroit Stokers . . . overthrow spreader and underfeed types for commercial, industrial and utility boiler plants—also for incineration of both municipal and industrial wastes.

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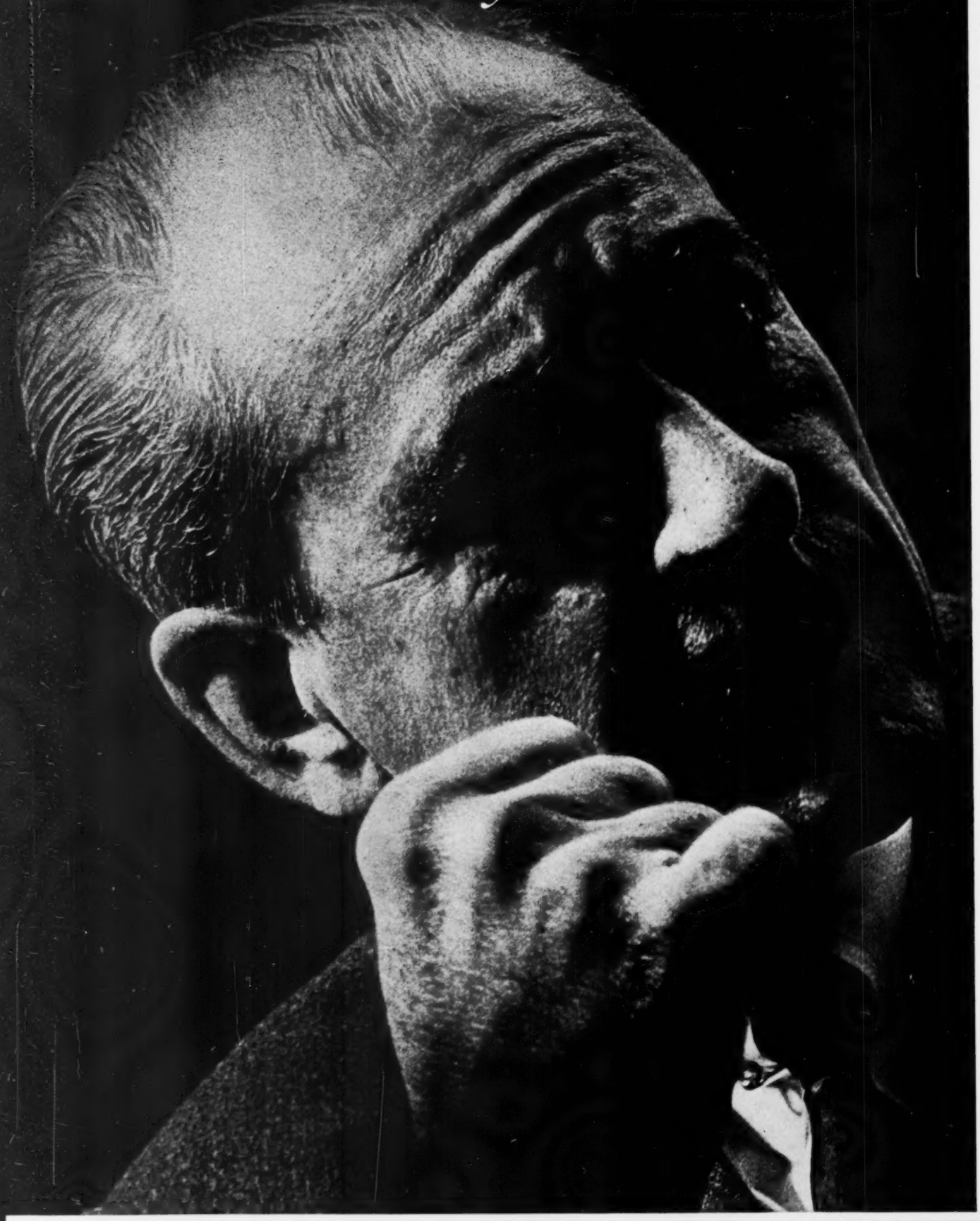

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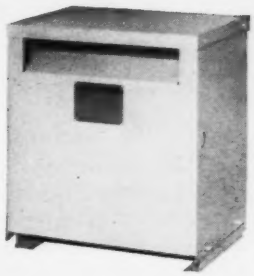
...and QUIETNESS is one of the big advantages of General Electric dry-type transformers



There's no reason to have noise complaints on transformers! Just make sure you specify the transformers which are designed with the complete sound spectrum in mind—General Electric's complete line of QHT* dry-type transformers.

HERE'S WHY: General Electric has considered not only the *volume* of transformer noise but also the *tone* qualities. General Electric QHT dry-type transformers have up to 15 decibels lower sound ratings (volume) than NEMA standards. Sound spectrum tests (tone) in General Electric's Sound Laboratory, located in Fort Wayne, Ind., have permitted G-E engineers to study the QHT design and vary its components to give you a *balanced design*—the best balance between electrical performance and sound qualities.

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Your customers look for you to know the difference in transformers. Make sure you do! Ask for the complete story on G-E dry-type transformers. Your local General Electric Distributor or Apparatus Sales Office can show you the advantages of G-E QHT transformers. Or send in the coupon below for GEZ-2506A, "Sound Testing of QHT dry-type Transformers."

*Quiet High-Temperature Dry-Type Transformers.

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Congressman Scherer Supports Highway Design by Consultants

For consulting engineers, highlight of the recent National Society of Professional Engineers annual meeting in Boston was the speech of Congressman Gordon H. Scherer (R.-Ohio), member of the Congressional roads subcommittee.

"We get some idea of the magnitude of this program," Congressman Scherer said, "when we realize that, if we could have a public works program which would combine the Panama Canal, the Grand Coulee Dam, and the St. Lawrence Seaway into one tremendous construction project, and then multiply it 35 times, we would have the equivalent of this highway construction program.

"During the hearings on the 1956 Act we were told by the experts that the 40,000-mile interstate system would cost $27 billion to build. Today we know that, in order to complete the interstate system as now contemplated, it will cost $40 billion or more.

"When the funds ran out, when the construction program had to be curtailed . . . there were some people, both in and out of Congress, who panicked . . . They looked for scapegoats. The Bureau of Public Roads and state highway departments became the chief whipping boys and so did private consulting engineers. In the short space of a few weeks we developed an amazing number of sidewalk highway engineers and experts on road legislation.

"One of the principal charges was that the interstate system was overdesigned; that the rights-of-way were too wide and the interchanges too complex; and that the entire highway layout was adorned with too many frills. It was then that the roof fell in on you consultants and you wondered who had kicked away the supports.

"Well, I will tell you. These charges of overdesign were the answer to the professional bureaucrats' prayer, the boys who believe in bigger and bigger government and the paternalistic, all-powerful state. For quite some time these professionals have been attempting to build up and expand the engineering departments of the Federal government. This is the very nature of the bureaucracy with which we are plagued in this country and, believe me, it is not confined to one department, one agency, or one field of activity.

"You private engineers should not get too chesty and feel that you are the only segment of private enterprise that is constantly being given the bum's rush by the professional bureaucrats and politicians who believe that the great white father in Washington knows best. This charge of over-designing gave these boys the club they have been looking for to knock you completely out of government work. So you were charged with overdesigning and overbuilding so that your percentage cut for engineering services would be higher.

"To say that the taxpayer will save money by having the various agencies of the Federal and state government set up huge staffs and bureaus to perform all of the engineering services required by government for all of its public works programs, including highways, is plain, unadulterated nonsense. I have been around Washington just long enough to know that, whenever it is possible to have private enterprise perform a service, it is done more economically and more efficiently than when government tries its hand.

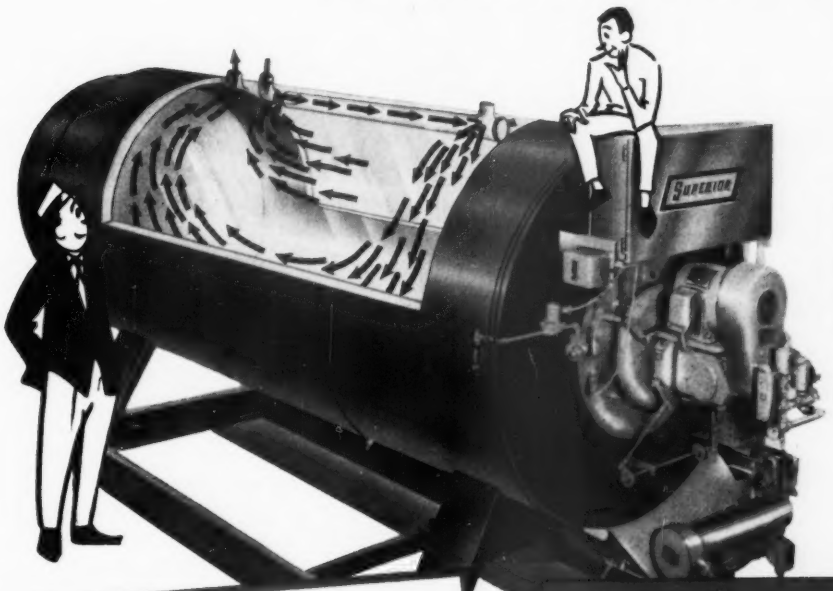
"Let me give you the prize example. As you know, during the eight years I have been in Congress, I have been a member of the Committee on Public Works. I have heard the liberals, the spenders, the proponents of big government and the welfare state, use TVA as an example or yardstick of a successful government operation. Every time the proponents and operators of the Tennessee Valley Authority come before our Committee, they go back to the Valley with their arms in slings from patting themselves on the back for their accomplishments.

"I am no engineer, I am no businessman, just an ordinary lawyer, but if I could not operate an enterprise successfully if the government gave me all the money to start the business, provided additional amounts when I needed to expand it, and did not require me to pay any income taxes, my parents ought to disown me.

"Now why do I mention TVA? Simply because it is the best illustration of the point I want to make. Of all the government agencies, TVA is the only one that has its own fully staffed, engineering department and never uses private consulting engineers in any way. You guessed it — it is at the head of the class — it takes first prize as having the highest engineering costs of all governmental agencies for the type of engineering services required. Need I go further?

"The Atomic Energy Commission, which has only a skeleton engineering staff of its own to make preliminary studies and to supervise the Commission's construction projects, makes the greatest use of private consulting engineers. Ac-

look what's happened to hot water boilers!



No, we're not making them with windows . . . we did that in the illustration to show you our NEW Venturi-action Mixing Tube which is the talk of the industry.

Venturi-Action Mixing Tube plays a triple role:

1 It starts by mixing entrained water from the boiler with water entering the boiler.

2 Traveling through the tube, the temperature is further modified by the surrounding water.

3 Jet action at the end of the tube directs flow downward and outward against the outer confines of the shell, providing a circulation pattern unequalled in any other hot water boiler.

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No hot water boiler can be made to withstand severe and repeated Thermal Shock . . . but this new Superior Boiler is designed to reduce it to a minimum.

Available in sizes to 600 BHP, Superior's Hot Water Boiler is the answer to trouble-free hot water heating.

For details of Superior's Hot Water Boilers in sizes to 350 BHP write for catalog CCW-13.
For sizes from 400 to 600 BHP write for catalog CFW-13.

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SUPERIOR PACKAGED BOILERS

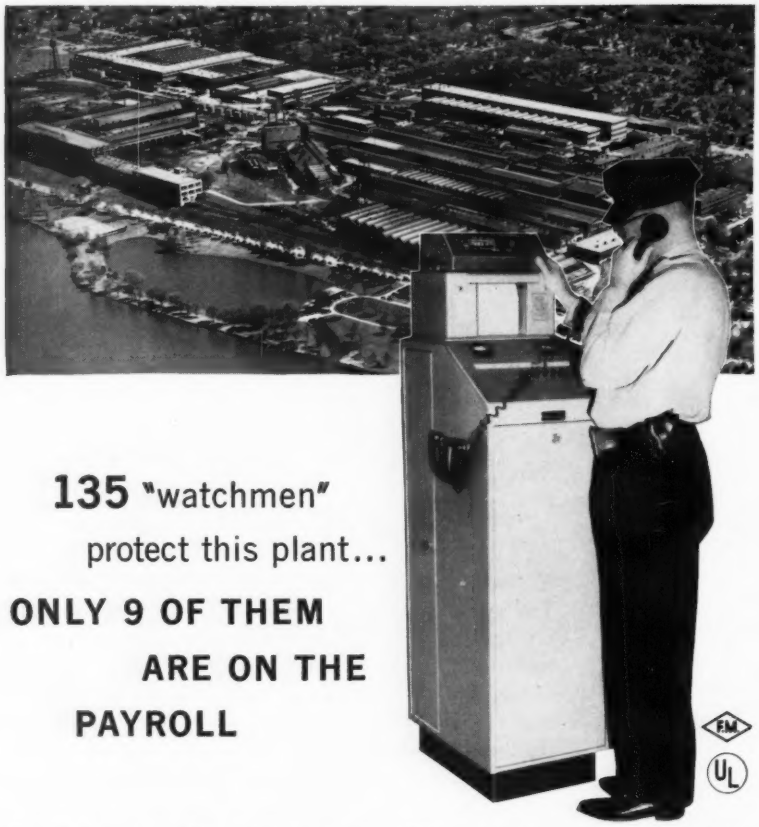
cording to the Hoover Commission Task Force Report, its engineering costs are 5.23 percent which are the lowest of any government agency. It is significant that those agencies which make the least use of private consulting engineering organizations have the highest costs, some running as high as 17 percent. In fact, the engineering costs of agencies increase in proportion to the lesser use they make of the services of private engineers.

"And don't let those who are crying crocodile tears and looking for whipping boys because of the increased costs of the highway program tell you that it is different when it comes to highway engineering services. The companies and organizations which built most of our toll roads with private capital have used the highest standards of highway construction because they want to be able to handle the tremendously increased traffic loads in the next 5, 10, and 15 years. The toll road people, to be able to pay off their bondholders, had to keep their costs at a minimum. All the engineering work on these toll roads was done by private consulting engineers. These costs, as you know . . . averaged considerably lower than the engineering costs for any publicly constructed highways. By contrast, the State of California which has a fine highway engineering department and does all of its own highway engineering services has a comparable cost of 24.1 percent.

"Now don't get me wrong. The various highway departments of the several states are excellent organizations headed by competent and dedicated men who are doing an outstanding job in getting this mammoth highway program under way. To their credit they have used, particularly in urban areas where the design is unusually complex, consulting engineering firms. It is not the fault of these men if their costs are higher.

"This always happens, as I have pointed out, when government performs a service. It is the very nature of bureaucracy. It is the result of the way government works, the result of political and other pressures, and the fact that the department does not have to make a profit or pay taxes as do your private organizations.

"There are peaks and valleys, as we all know, in highway construction. We had a cogent example last year when the highway program ground almost to a halt because Congress dawdled and politicked and for nine months failed to provide the necessary moneys for the depleted trust fund. A great big valley resulted which hurt everyone connected with the highway program. The contractors and engineers who had expanded their organizations and invested large sums of money, some through borrowing, in order to meet this great construction challenge, were left sitting, holding the bag because of



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the drop-off in awarding contracts

not the fault of the state highway

government, which is not entire-

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In fly ash collection the specification of electric precipitators is... increasingly... "Buell". The 1959 central station design survey published by POWER magazine in October, 1959 shows that Buell installed 8 out of 22 precipitators. And that high proportion was not surpassed even by the longest-established manufacturer in the field! ■ Why this fast-growing demand for Buell electric precipitators? There are many reasons. Unique design features minimize maintenance and provide exceptionally high efficiencies. In 10 years of selling Buell SF Electric Precipitators, the number of spare and replacement parts ordered from Buell has amounted to less than 2% of the total sales! You seldom replace Buell's exclusive 'Spiralectrodes,' because the rigid fastening makes sure they won't break. Their precise construction of strong-heavy stainless steel prevents rust and corrosion. ■ See for yourself some of the reasons why men in many industries are specifying Buell SF Electric Precipitators. Send now for details. The Buell Engineering Company, Inc., Dept. 47-G, 123 William St., New York 38, N.Y. Northern Blower Division, 6404 Barberton Ave., Cleveland, Ohio. (Subsidiary: Ambuco Ltd., London, England.)

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Whether by automobile or move-

the drop-off in awarding contracts they had been promised by the 1956 Act.

"As I have said, there are peaks and valleys in this game. When a state highway department builds up an organization of sufficient magnitude to take care of the engineering services that are so vitally needed during the peaks, then it has a lot of people sitting around, twiddling their thumbs during the valleys. This costs money – this is waste – and it is not the fault of the state highway engineer if the professional politicians want that kind of operation and adopt that kind of a policy.

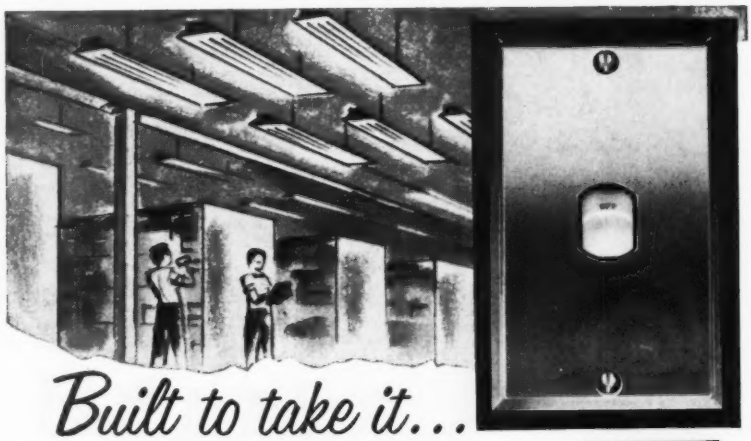
"In contrast, the private consulting engineer during the off-seasons has his organization geared to perform a dozen different types of engineering services not only for other agencies of government but also for the great private industrial empire in this country.

"I am aware of the fact that the General Accounting Office of the government, which is not entirely free from the attitude of the professional bureaucrats I have been talking about, last year complained about the use of private consulting engineers on the highway program and blamed some of the increase in costs on their use. Now, as I have said, you are going to find an occasional instance where they will be able to substantiate that charge, but I will bet my last dollar that on the thousands and thousands of highway projects, this charge will not stand and that the very opposite is true. In fact, if you read GAO's report carefully, you see that it makes the general charge without substantiating it by competent evidence or reasonable arguments.

"In spite of the findings and recommendations of the Hoover Commission, you are going to have an increasing demand for bigger and bigger engineering departments and for the elimination of private engineering services in government work. The only way to stop this assault on this particular segment of the private enterprise system is to bring about an informed public opinion through an educational process.

"This Special Highway Investigating Committee of which I am a minority member is going to investigate private engineering costs. I assure you there is a lot of preconceived sentiment for the reduction or elimination of private consultants in highway work.

"We must insist that before any action is taken, an unbiased study be made of highway construction engineering costs by both government agencies and by private engineering companies. In other words, the Hoover Task Force Report made in 1955 must be brought up-to-date. I myself have no doubt as to the outcome of an impartial survey, especially if there is taken into consideration the fact that private organizations pay taxes back to the Federal government on whatever profit they make." ▲▲



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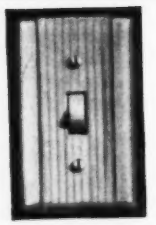

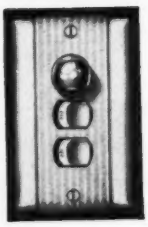

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P&S Rocker-Glo switches are AC switches, designed to be used at full current ratings on tungsten filament and fluorescent loads – one does the work of two AC-DC switches for controlling fluorescent fixtures. Rocker-Glo can be used anywhere old-style toggle switches are used.

Rocker-Glo is sturdily constructed. Its rugged, wall-hugging luminous rocker is not subject to breakage from accidental blows as is the case with ordinary switch handles. It's built to withstand punishment ordinary toggle or specialty switches cannot take – changes no wiring habits. Single Pole and Double Pole switches are indicating – you can tell when they're on or off.

Available in Despard interchangeable type, Despard Type mounted on strap and narrow rocker for tumbler switch plates. A specification grade switch, 15 and 20 amps. 120/277 volts AC.

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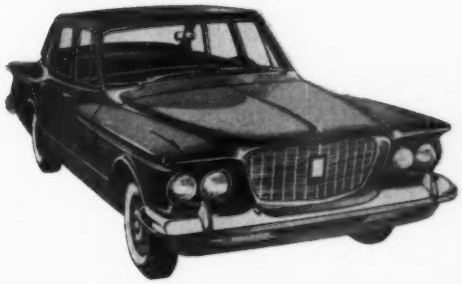

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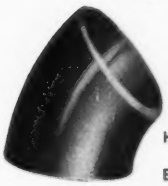

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Nation's Water System Inadequate

AWWA Annual Conference Report

WITH AN INCREASING population, a deteriorating water supply system, and a predicted need of 600 billion gallons of water a day (about half the average runoff of all the streams in the country) by 1980, American engineers were told to stop watching the skies for a miracle and get out their slide rules at the recent American Water Works Association's 80th annual conference.

Theodore M. Schad, staff director of the Senate Select Committee on Natural Water Resources, said in the first public report issued by the two-year-old organization, "We cannot count on a miracle to help us out. Reports on desalting of seawater and artificial inducement of rainfall give no concrete evidence which would lead one to expect early success. In my opinion, it would be a grave mistake to place any great degree of hope on finding an early solution to our water problems from either of these sources."

Raymond J. Faust, AWWA secretary, predicted annual construction needs of more than $1 billion per year for the next 20 years to cover current water system deficiencies, anticipated population increases, and the cost of improving water quality. Biggest single item in Faust's future was providing water to keep up with population growth. Based on figures from Louis Howson, Chicago consulting engineer, Faust said it takes $250,000 capital investment at 1959 prices to add service for each 1000 new consumers. Average population growth is expected to total almost four million a year between now and 1980. Making a total 20-year expenditure of something over $16 billion.

Water System Deficiencies

But the current system is far from adequate. Faust referred to a 1955 survey by the U. S. Public Health Service which showed that of the water systems serving communities of 25,000 or more, one out of five was deficient in supply, two out of five in transmission capacity, one out of three in pumping capacity, two out of five in treatment capacity, almost one out of three in ground storage capacity, more than 40 percent in elevated storage capacity, and over half in distribution facilities.

A follow-up showed that the situation had gotten worse since the study. A Commerce Department spokesman estimated that merely correcting present deficiencies would cost $5 billion. Spread over 20 years, this would be $250 million annually.

(In analyzing the situation, Faust stressed one method of getting public approval for the vast new programs needed. . . "Get the services of a consulting engineer to substantiate your position and get the cost of the program.")

In addition to Faust's impressive sums, Schad predicted a huge construction program on river control and storage projects. Stressing that he was giving only his own unofficial predictions, Schad foresaw a need for dams and reservoirs to make possible complete control of river flows, a condition previously experienced only in the more arid regions of the West.

"The key to the future sufficiency of water," according to Schad, "appears to lie in increasing reuse of available water supplies. Primary attention should be given to improving our methods for pollution abatement and increasing river regulation, moving ultimately toward full regulation of stream flows in many of our rivers. Even these methods will not be effective unless new techniques for removing or keeping wastes out of our streams can be devised.

"By 1980 – 20 short years from now – at least 5 of 22 water resources regions into which the country has been divided for the purposes of the Committee's studies, will have generated demands for water that will exceed the sum total of the available supply, even with widescale reuse of water. This will necessitate either the importation of water from other river basins or the making of decisions as to which uses of water would have to be foregone in deference to other, more desirable, uses,

"These regions are, of course, in the southwestern part of the country, but the Committee is not in a position to release specific figures on them until the studies are completed and checked.

"Computations by Resources for the Future indicate that the flows needed for dilution of sewage and industrial wastes under present treatment techniques will be extremely high. In fact, they will become the ruling flows in the highly congested, urban-industrial areas, such as in the northeastern part of the country, unless means other than dilution with clean water can be found to preserve the oxygen content of such streams. The Public Health Service's computations of the amount of water required, based on extrapolations of various methods for computing the ability of streams to assimilate wastes, indicate such a large quantity

Brand new AUTOMATIC WATER SOFTENER

Joins the Elgin Line ...at a new low, low price

This brand new Elgin Automatic Water Softener employs the Elgin time-proved multiport valve with simple, and therefore dependable, motorized lift-turn mechanism.

This simplicity of design not only gives it dependability of operation, but also permits selling it at a low, low price despite the fact that it is built to traditional Elgin quality standards.

Like all Elgin Water Softeners, this new automatic is also available in the revolutionary "Double-Check" design described below. Now more than ever before it will pay you to get a quotation from the Elgin man before you buy.

Available in Elgin "Double-Check" design

Yes, this new automatic—and the softeners with the two other controls described opposite—are available in the "Double-Check" design which gives these money-saving features:

1. Zeolite locked in . . . prevents costly replacements.
2. Being locked in, zeolite can be backwashed more thoroughly without loss . . . to keep softener clean, efficient, long lived.
3. Clean, receptive zeolite bed, plus highly efficient brine distributing system, means complete regeneration with marked salt savings.
4. Deeper zeolite bed of "Double-Check" softener gives far greater softening capacity from given size softener or equal capacity from smaller one.

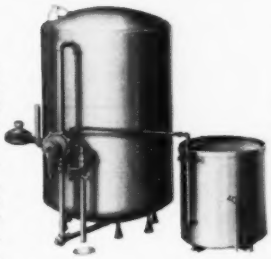
Ask for Bulletin 615

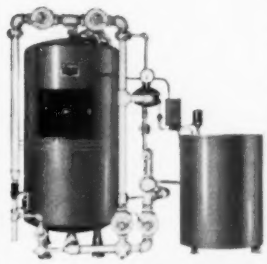
Complete facts about Elgin softeners and other equipment listed below are given in Bulletin 615. It is yours for the asking. So too are the services of the nearest Elgin representatives. They are listed in the yellow pages of phone books in principal cities under "Water Softening & Treatment."

Choice of two other outstanding controls

MANUAL MULTIPORT

Thousands of water softeners with the manual multiport valve control attest to its excellent performance and rugged construction. All operating steps are controlled by one simple revolution of valve handle.





HYDRAULIC ULTRAMATIC

For those who want the finest in automatic operation, this hydraulic "Ultramatic" is the answer. Its time-proved hydraulic valves and automatic pilot give the ultimate in dependability and control.

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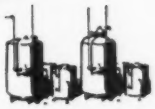
SOFTENERS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FILTERS

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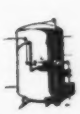
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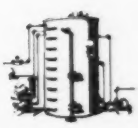
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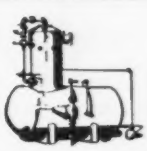
DEAERATING HEATERS

of storage will be required for dilution that new techniques for handling wastes will have to be developed as the most economic way of dealing with waste disposal.

"It is evident that our present methods of treating sewage and industrial wastes must be overhauled. As the Public Health Service has advised the Select Water Committee, new treatment processes, probably based on entirely new concepts and principles, may be required. Presently known methods such as lagooning of wastes, and rapid oxidation may come into increasing use."

Saline Water Conversion

The minority viewpoint on fresh water from the sea was set forth by Allen Cywin, assistant director for Demonstration Plants of the Office of Saline Water, and Lewis S. Finch, vice president and chief engineer of the Indianapolis Water Company.

According to them, "Worldwide, nearly 20 million gallons of fresh water now are in production (from desalting) each day. Small in terms of our larger city and industrial requirements, this represents a 15-fold increase in the past decade.

"In 1952, the costs for saline water conversion . . . amounted to $4 to $5 per thousand gallons. Those costs were high partly because the plant sizes were small and also because the equipment was designed primarily for marine service. Now that a market for civilian equipment is developing, the individual plant size and the efficiency of operation has improved, thereby permitting a realistic present-day cost of conversion of less than $2 per thousand gallons for presently installed plants.

"Saline water plants now under construction and being designed should be capable of producing water at close to $1 per thousand gallons in plant sizes of approximately 1 mgs. When one considers the inflationary period of the 1950s, one truly must be proud of the industry-government's 400 percent improvement in process costs in the past decade.

"There are some communities in the United States today that pay $5 to $7 per thousand gallons for hauled water. As a portent of things to come, one of those communities – Coalinga, California – recently purchased a small electrodialysis demineralizer and thus has become the first American municipality to utilize this new and superabundant resource – saline water. In this instance, brackish ground water."

Conversion by Freezing

In listing methods of desalting water (distillation, membrane, freezing, and chemical), the two men termed freezing the dark horse. Freezing (separating fresh water ice crystals out of saline water)

RECOLD

Fourteen Recold Multizone units provide the complete heating and cooling requirements for Tidewater Oil Company's new world-wide headquarters in Los Angeles. This ultra-modern building features the newest innovations in office traffic and communication - and the best in customized climate – by Recold, of course.

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Doesn't it make sense to insist on **V**isible **B**lade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because ***Square D switches have never been out of first place in more than 50 years!***

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has the advantages of lesser tendency to scale and corrode, as well as the ability to operate with less thermal interchange. There are at present two leading freezing methods with a good potential for economically producing sea water ice — freeze-evaporation and direct refrigerant cooling.

Carrier Corporation designed and built the first freezing saline water conversion pilot plant of any appreciable size (15,000 gpd) and will build another more than twice that size this summer at Harbor Island, Wrightsville, North Carolina. In the existing plant, synthetic sea water is introduced into a high vacuum chamber and is flash-cooled to a temperature low enough to produce ice crystals. The water vapor is an additional source of purified water and is either mechanically evacuated from the freezing chamber or handled by an absorption unit. The ice crystals are washed free of the brine in a countercurrent wash chamber.

Blaw-Knox is building a different type pilot plant near St. Petersburg, Florida. In this system a refrigerant such as isobutane is introduced directly into the brine, thus freezing some of the solution into ice crystals. "The use of a direct refrigerant greatly reduces the size of compressor needed as compared to the other cycle but adds the complication of handling a second fluid with little or no loss allowed," the speakers added.

Omar C. Hopkins, of the U. S. Public Health Service, told what kind of drinking water tomorrow's public is likely to demand. "It appears so far that there will be almost no change in the microbiological requirements, relatively few changes in the requirements regarding 'source and protection' and physical aspects, and a number of changes in the chemical limits."

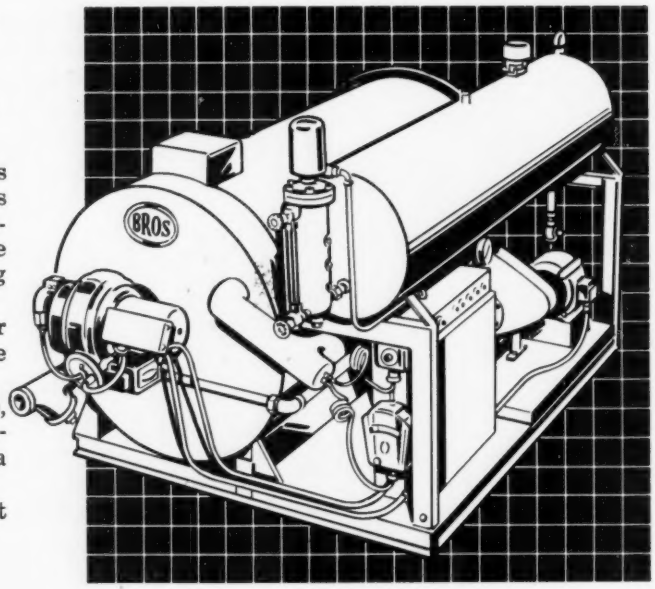
Other Water Problems

And what makes water mains break? A panel says, "One of the major causes of main breaks in Philadelphia is changing traffic conditions. Modern heavy trucks and similar vehicles impact loads to the underground structures beyond those for which older pipelines were designed. This is particularly true in the winter months when frost penetration transmits surface shock to greater depth. Another important factor is stray current electrolysis which is created by the now abandoned street railway system."

And in New York City . . . "Of the many contributing causes for water main breaks, the unequal settlement of the soil in which the main is laid (especially along subway routes) and the settlement of subsurface structures (electrical conduits or gas and steam mains) are frequent and serious offenders." ▲▲

HEAT PROCESSING NEEDS OF UP TO 600° F.?

BROS Liqui-Therm Heaters Provide these at Low Working Pressures



The BROS Liqui-Therm Heater provides 850,000 to 50,000,000 BTU requirements for modern industrial processing high temperature demands of up to 600° F. These temperatures are produced at working pressures below 15 psi.

A variety of heat transfer media under forced circulation can be used to achieve accurate control of high temperatures.

BROS Liqui-Therm Heaters, Watertube, Package, and Cornertube® High Temperature Water Boilers are available through a national sales organization.

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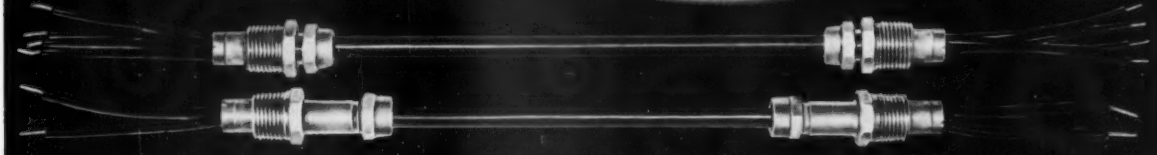
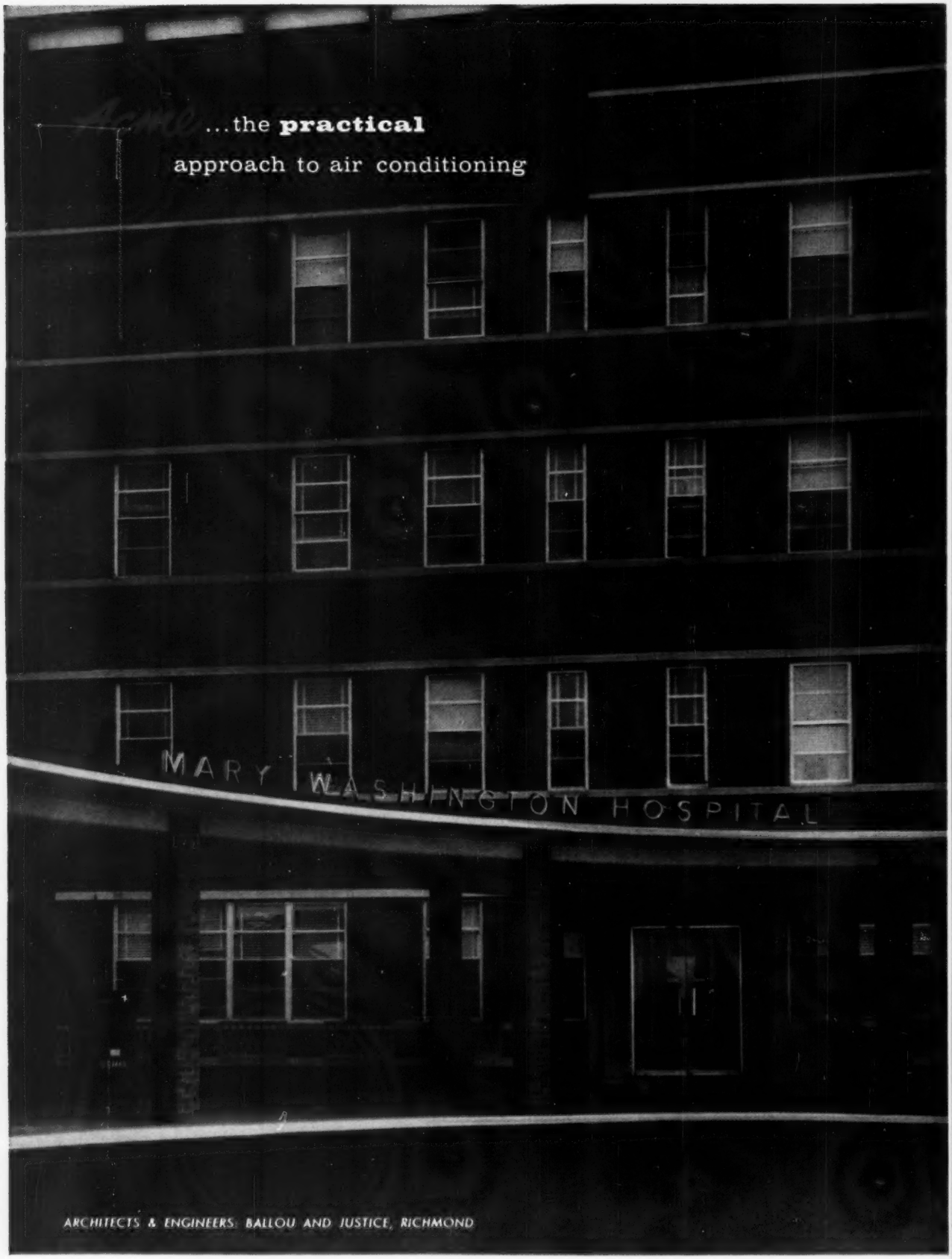
Safety Mineral Insulated Cable for a greater variety of 600 v applications than any other wiring system*

MI Water Resistance: Impervious to water, steam, oils and solvents. MI is ideally suited for installations where these factors cause ordinary cables to break down. MI has helped eliminate costly shutdowns in dairies and food processing plants where washdowns are a daily function. **MI Heat Resistance:** Unlike any other cable system, the limiting factor for MI heat exposure is the copper components of the cable. The magnesium oxide insulation is heat-stable until well over twice the melting point of copper (1083C). With an MI system as opposed to conduit there is no need for circuitous routing to avoid contact with boilers, machines and other sources of heat. Cable operating temperature is 250C, but standard general application (Type O) and hazardous areas (Type H) seals are limited to 85C. **MI Flexibility:** No need for factory-made conduit bends...MI can be hand formed on the job and easily clipped into position. MI is able to withstand severe twisting, bending and deforming pressures because the conductors cannot shift within the highly compressed magnesium oxide insulation. For a copy of our new MI catalog, write **General Cable Corporation**, 730 Third Avenue, New York 17, N.Y. Manufacturers of MI Cable since 1941. Mineral Insulated Cable Division



Approved for hazardous areas in the 1959 National Electrical Code, Articles 330, 501, 502 and 503.


...the **practical**
approach to air conditioning
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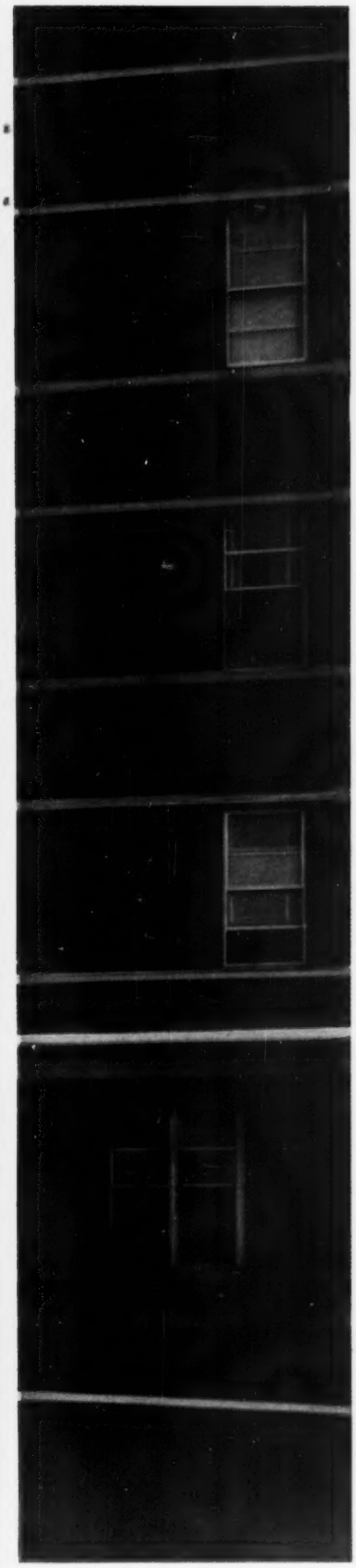

For a growing hospital...
comfort conditioning
by Acme

Mary Washington Hospital, Fredericksburg, started back in 1899 in a five-room frame cottage. Today, after 61 years of progress and steady growth, the Hospital boasts 150 beds, a 20-bassinet nursery and completely modern facilities throughout . . . including Acme-system comfort conditioning for the recently added third and fourth floor nursing units.

The patients, of course, are the primary beneficiaries of the year 'round comfort that Acme air conditioning provides but they're not alone in their appreciation, for John T. Ellington, Fredericksburg contractor who installed the system, had this to say . . . "When I take on a job, I prefer to buy from one manufacturer, if the equipment meets specifications. I selected Acme because their equipment not only met specifications, but was available for fast delivery so we could meet our deadline. Further, there were no installation problems with the Acme chiller, cooling tower or multi-zone air handler. These units are factory assembled and pre-tested . . . no need to assemble on the job. I just put them in the building and hooked them up."

Mr. Ellington stated, too, that "this June will complete two years of continuous operation and there hasn't been a service call involving the Acme equipment."

How can you beat it? . . . simple, low-cost installation . . . factory-tested performance reliability . . . minimum maintenance . . . client-pleasing operation. And all of this mind you, assured by a name that has stood for quality air conditioning and refrigeration equipment since 1919 . . . ACME.

Acme INDUSTRIES, INC.

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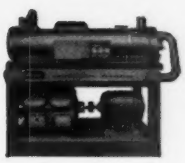
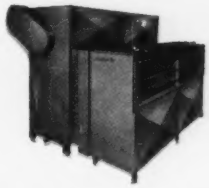
Manufacturers of Quality Air Conditioning and Refrigeration Equipment Since 1919



Packaged Chillers
1½-250 tons

Cooling Towers
3-120 tons



Air Handlers
665-47,000 cfm

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MASTER TV SYSTEM INSTALLATION MANUAL

All the facts that you need to assure top and dependable master TV system performance. Contains information that is the result of more than 2,000,000 master TV installations featuring Blonder-Tongue Masterline equipment:

CONTENTS

TYPES OF SYSTEMS
New construction; old construction; vertically designed systems; horizontally designed systems.

COMPONENTS IN MASTER TV SYSTEMS
Amplifiers; splitters; tapoffs; antennas; transmission line.

THE 'HEART' OF MASTER TV SYSTEMS
"Head-end"; amplifiers; line filters; feed-thru couplers; radiation-proof housings.

'ARTERIES' OF MASTER TV SYSTEMS
"Branching"; splitters; cable; tapoffs; isolation.

ANTENNA INSTALLATION
Orientation, "directivity"; signal strength; towers and masts.

LINE INSTALLATION
Balanced transmission; co-ax cable: RG/11U and RG/59U; 300 ohm ribbon line; baluns, matching transformers.

DESIGNING AND CALCULATING MASTER TV SYSTEMS
Typical system diagrams; vertical cable run systems; hotel, apartment—to 400 outlets, new construction, existing construction; horizontal cable run systems: School or hospital—100 outlets, new construction, hospital—400 outlets, old construction; trailer park system—148 outlets, new or old construction.

TESTING AND MAINTAINING A SYSTEM
Equipment for servicing a system; substitution method; field repairs; testing and maintaining cable.

CHARTS AND TABLES
Amplifier specifications; tapoff—isolation networks; cable characteristics; attenuator pad construction; half wave open ended stub traps, and more

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Parallel Reading for Consulting Engineers

Journey to America, by Alexis de Tocqueville, edited by J. P. Mayer; Yale University Press, New Haven, Conn.; $6.50.

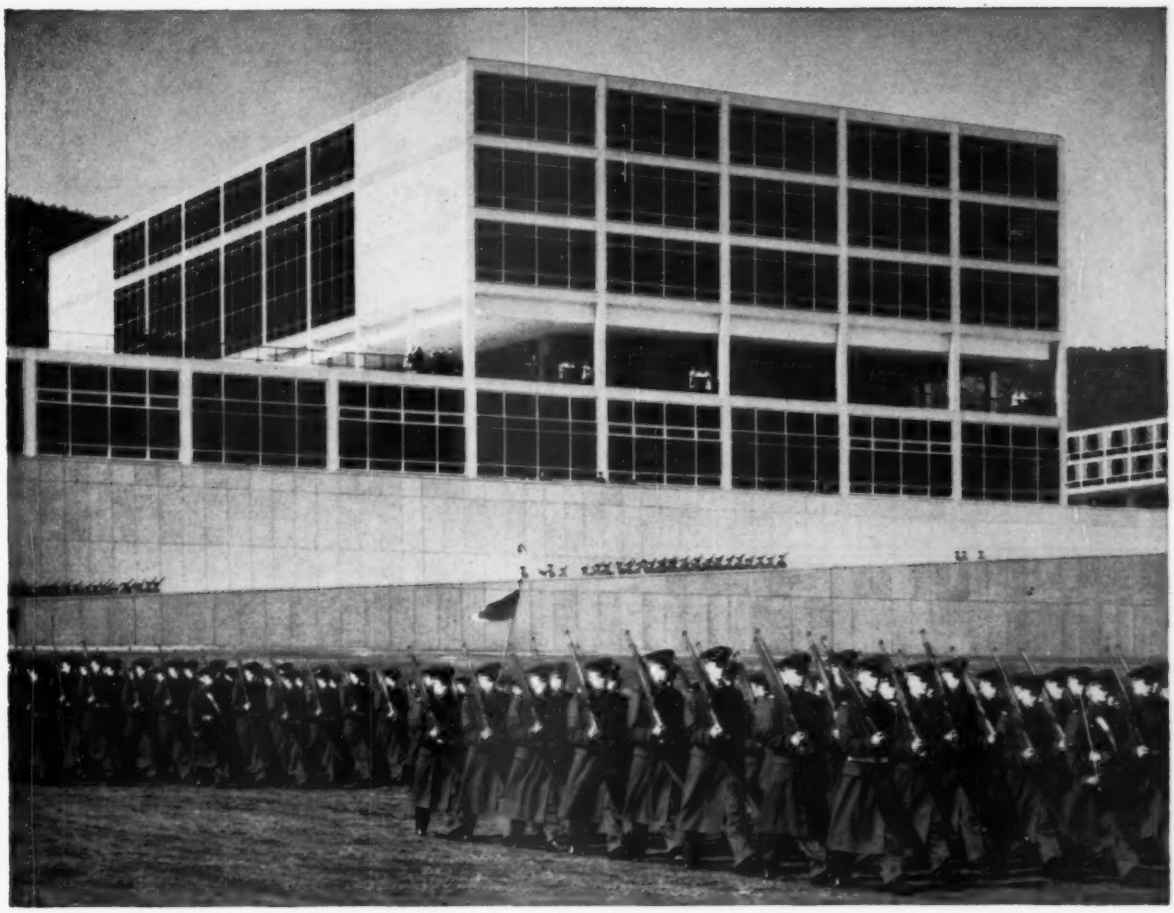
When he visited America in 1831-32, the young French lawyer, Alexis de Tocqueville was actually on a mission to study our prisons and penal methods. While he did visit Sing Sing and a few other institutions, jails were of secondary interest to him. He was much more fascinated by this young democracy, brought together, as he saw it, in a violent mixture of party politics, public education, the jury system, slavery, and religion. He traveled from Canada to Louisiana, from Boston to St. Louis, and he talked with many of the important persons of the time. He carefully records with regard to his own personal opinion, the conversations of Joel Poinsett, of South Carolina, John Quincy Adams, of Massachusetts, and some French Canadian trappers sitting around the camp fire north of Mackinac.

This book is a translation of several of de Tocqueville's notebooks, the basic material he used in writing his great classic *Democracy in America*. These notebooks are to *Democracy in America* what Boswell's *Journals* are to his *Life of Johnson*. And while de Tocqueville is personally quite the opposite of Boswell – he is unemotional and seldom injects himself into his notes – his style and his data are both fascinating and enlightening for the reader.

When de Tocqueville visited the United States, Andrew Jackson was President, and our party system was just flexing its muscles. It is clear that de Tocqueville is surprised that such good government can come from such middling office holders. There are few great men about. De Tocqueville thinks that Charles Carroll of Maryland is about the only person he has met here who is an exact counterpart of a European gentleman. "Probably the great Southern landowners at the time of the Revolution were all of such sort. That breed of men, which provided the greatest names in America, is disappearing. With them the tradition of cultivated manners is going. The people become educated, knowledge spreads, and middling ability becomes common. Outstanding talents and great personalities are rare. Society is less brilliant and more prosperous. The various effects of the progress of civilization and enlightenment, about which only Europe is in doubt, can be seen as clear as day in America."

The reader will get a new concept of the United States in the first half of the 19th century. It is a startling picture. De Tocqueville points out that, compared with other nations, the United States is by far the most educated. Nowhere else does one find the average man able to read, write, and argue politics with intelligence. De Tocqueville agrees that democracy is remarkably wonderful in America, but he still has some doubts concerning its application in Europe until there is a more general

Continued on page 166

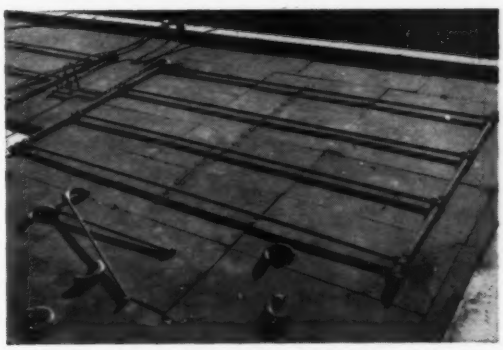


At the end of the day, **steel pipe** brings the comforts of home to the airmen of tomorrow

Saturday's parade ends a schedule-filled week for 1,500 cadets at the U. S. Air Force Academy near Colorado Springs. From the parade grounds the cadets return to their quarters . . . the world's most modern in comfort and convenience for housing the nation's air-leaders of tomorrow.

Steel pipe contributes much to making the Academy the world's finest. For radiant heating over five miles of *steel pipe* were used. In the 17,800 acre Academy Complex, the plumbing, vent and drainage lines were fabricated from *steel pipe*. And, it was used because—in an evaluation of service life, ease of fabrication, availability and cost—*steel pipe* proved superior to any other tubular product.

At the U. S. Air Force Academy, as in buildings throughout the nation, *steel pipe* is the perfect, low cost tubular conductor of water, gas and oil. The high thermal conductivity and structural strength of *steel pipe* make it ideal for many applications including radiant heating, cooling, refrigeration, ice making, snow melting, electrical conduit and myriads of residential, commercial and industrial applications.



Prefabricated steel pipe sections resulted in quick and easy installation for the radiant heating system at the Academy. Because the coefficient of expansion of steel pipe and the concrete slab in which it's embedded are compatible—long service life is assured.

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Plumber's Progress

The Subject is a Peculiar One...

Thirteenth century rub-a-dub-dub.

The Pedestal Lion closet of the '90s.

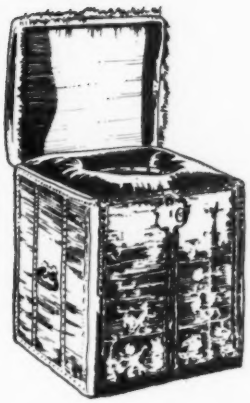
Clean and Decent, by Lawrence Wright; Viking Press, New York, N. Y.; $4.95.

Subtitled, "The Fascinating History of the Bathroom & the Water Closet and of Sundry Habits, Fashions & Accessories of The Toilet, Principally in Great Britain, France, & America," this is a book dealing with a narrow field of broad interest — a subject close, may we say, to all of us. The illustrations, alone, are worth the price, but in addition Mr. Wright, it turns out, is an excellent and erudite Englishman who handles his chosen topic with taste, wit, and authority.

The history starts, as histories tend to, with Egypt, Greece, and Rome. It brings the reader up flush with the turn of this century. But Mr. Wright is at his best (and that is more than just good) when dealing with the Middle Ages. It is the 12th through the 14th century that shines here as really clean and decent.

Nobody then was shy. A pictured knight dismounts from his steed to attend his lady's open-air tub, and in medieval stories of amorous intrigue, Wright says, the two lovers usually began the evening by bathing together. Ideas of propriety were different from ours; the whole household and the guests shared one sleeping apartment, and wore no night clothes. It was not necessarily rude to be nude.

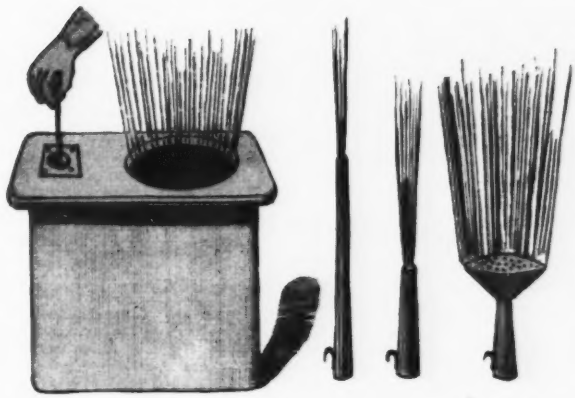
Consulting engineers might learn some new tricks from old layouts.



The Royal Close Stool at Hampton Court, c.1600.

Bath, England, "The King's Bath," in 1675.

The Dolphin, 1882.



The Fountain Bath or Ascending Douche, c.1870.

Bain en Forme de Sopha, or the Spirit of '76.

ASK ME ANOTHER

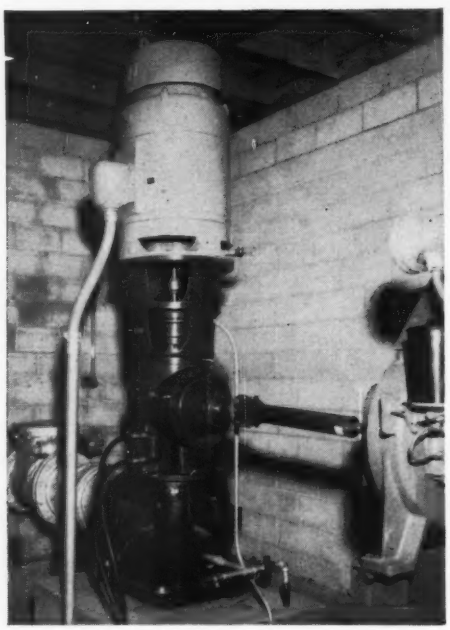
Does concrete containing calcium chloride have any effect on aluminum conduit?

Little effect! The normal amount of calcium chloride used in cement is 2% of the dry cement by weight. This amount won't harm either aluminum or steel buried in concrete. However, if excessive amounts are used, calcium chloride could possibly corrode steel or aluminum as well as have a harmful effect on the concrete itself.

For *all* the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.

KAISER ALUMINUM

Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, Oakland 12, Calif.



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***Redi-Torq*®**

Redi-Torq combination right angle gear drive with automatic clutch, eliminates manual switch-over to engine drive in case of power failure. Drive couples to engine by flexible shafting or couplings—engine clutch unnecessary. Engine may be tested without interfering with electric motor operation of pump.

For round-the-clock protection against power failure in water, sewage and fire installations. Developed and proven in municipal and industrial use over several years.

Sizes: 15 to 200 hp; hollow or solid shafts. Write for engineering catalogs.

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13-R

Continued from page 162

education of the lower classes. His notes on slavery are primarily economic but most enlightening.

This is one of the important books to have been published this year. It can be strongly recommended to anyone with the slightest interest in political, economic, and social conditions in this country something over a century ago. Unfortunately, it is poorly annotated so that one never knows except by prior knowledge just who the persons are that de Tocqueville is questioning. And few as the notes are, some are seriously wrong. For example, in a note dated August 2, de Tocqueville states, "The next day we are in sight of ———— situated at the mouth of Lake Huron. We enter that immense lake." A note referring to the blank in the manuscript reads, "Probably Sault-Saint-Marie." This is impossible. De Tocqueville actually is referring to Port Huron, for he has just gone up through Lake St. Clair from Detroit, and he is still 250 miles or so from Sault-Saint-Marie.

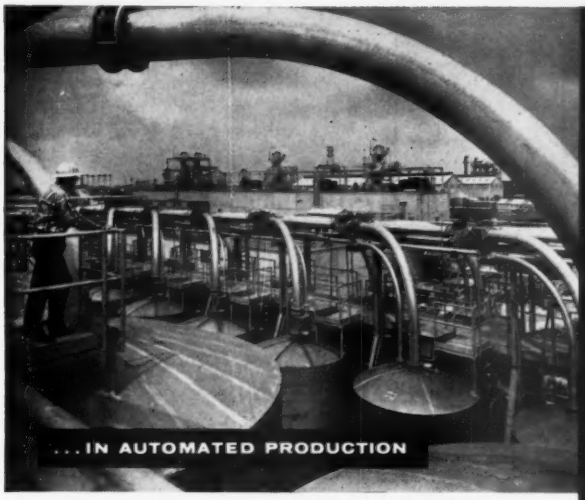
Despite the too few and too faulty notes, de Tocqueville manages to carry himself without the aid of an editor, and the translation from the French is excellent.

•

The Natives are Restless, by Cynthia Lindsay; Lippincott; $3.95.

This piece by Cynthia Lindsay is caustic froth, but it is gently caustic, barely capable of turning litmus paper blue. The lady author is a native of New York, now living in Beverly Hills, and she finds some of the more flamboyant mores of the natives to be worth recording.

So they are. She has done a good job, but a book is too much for her treatment of the subject while the excerpted article in the May *Harper's* is too short. Still, *Harper's* got the better of it, for with this type of writing, it is wise to leave the reader wanting



...IN AUTOMATED PRODUCTION

Airstream Conveyor Systems automatically handle polyethylene throughout all phases of production — drying, extruding, pelletizing, storage and bagging — at Phillips Chemical Co., Pasadena, Texas. High-volume, high-purity Dracco systems like this are used by most major plastics producers.

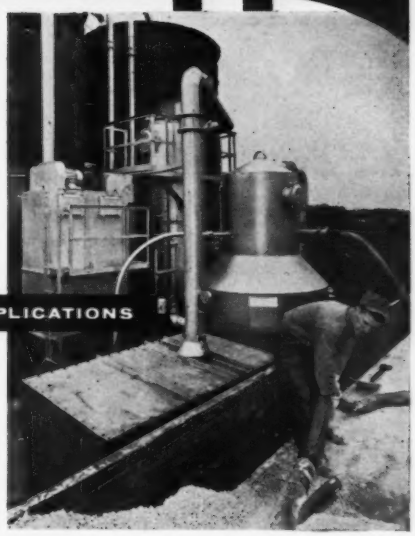
...IN MEDIUM-SIZED OPERATIONS

Typical unloading-to-storage-to-process systems, like this one at St. Louis feed supplement plant of Merck & Co., enable bulk materials users to take best advantage of other modern production techniques and equipment. Such systems are easily expanded, with minimum engineering cost, when handling requirements increase.

Dracco ***experience*** *gives you pneumatic conveying at its finest!*

...IN ADVANCED PROCESSING

Automatic in-plant materials distribution with Airstream Conveyors enables Western Electric Co. to apply new cable insulating and sheathing methods at Point Breeze Works, Baltimore. Systems carry 11 different colors of polyethylene pellets over distances up to 700 feet, supplying 50 extruding machines without contamination or intermixing.



...IN SMALL-QUANTITY APPLICATIONS

Airstream Conveyors prove economical in handling quantities as small as one carload a month, or the equivalent. This low-cost, ground-level system at a mid-western processing plant is used only periodically to unload lime from trucks to storage, yet provides important savings in materials and labor costs.

W*hether your dry materials handling requirements are large or small, simple or complex, it pays to install an air conveyor engineered by experienced specialists. To be sure you get the system best suited to your application, contact: Dracco Division of Fuller Co., Harvard Avenue and East 116th Street, Cleveland 5, Ohio.*

DRACCO *airstream* conveyors
dust control equipment

FULLER COMPANY GENERAL

ASK ME ANOTHER

Does aluminum conduit meet the requirements of the National Electrical Code?

Yes! The only requirement the Code makes is that conduit be metal—aluminum, steel, bronze or wrought iron. Steel conduit must be covered with a protective coating to help prevent corrosion according to the Code.

For *all* the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.

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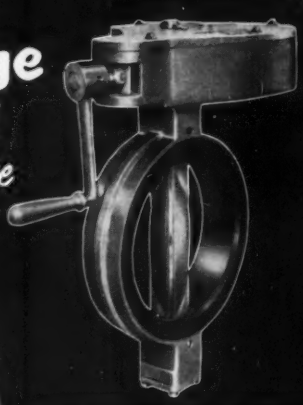
Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, Oakland 12, Calif.

PRATT®
Monoflange Mark -II
the versatile valve



THE IDEAL VALVE FOR O-150# pressures in a wide variety of uses. The Monoflange Mark II Manual is especially prepared for use by consulting engineers; the most up-to-date information on fluid flow, gas flow, operator sizing, prices, etc. Ask for Bulletin 10-J.

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more than to surfeit him in an attempt to fill the conventional inch or so that seems to be demanded between hard covers.

The book is amusing and at some points close to clever. Every Los Angeleno will read it as a defense measure, while everyone from Northern California (and their great body of sympathizers in the rest of the country) will enjoy the opportunity to smirk at smog and sport shirt civilization.

It is worth noting that the author inadvertently confesses some addiction to the ways of Southern California herself. This is, no doubt a sort of disease difficult to avoid if one lives long in the area. She is showing some of the symptoms. One gets the notion that Miss Lindsay has become something of a Procal herself. It is time she visited Great Neck again.

•

The Eddystone Light, by Fred Majdalany; Houghton Mifflin Company, Boston, Mass.; $4.00.

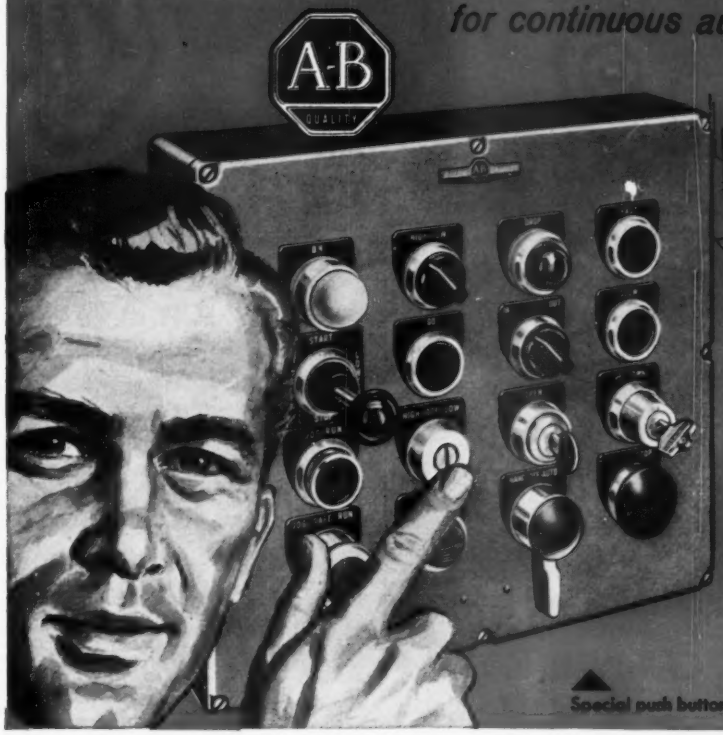
My father was the keeper of the Eddystone Light
And he slept with a mermaid one fine night;
From this union there came three,
A porpoise and a porgy and the other was me.
Yo, ho, ho, the wind blows free,
Oh for a life on the rolling sea.

Fourteen miles southwest of Plymouth the jagged rocks of the Eddystone Reef clear the angry waters of the English Channel at low tide. Here the westerly wind and current systems of the Atlantic collide with the complex local tidal system to create the chaotic stretch of water which has been the undoing of many sailors, many ships, and at least one mermaid. Here too rises the Eddystone Light, a slender tower of granite soaring 133 feet above the high water mark.

The Eddystone story begins with the rise of the British merchant fleet, for though Plymouth Harbor had long been the home of the

AUTOMATION BEGINS HERE

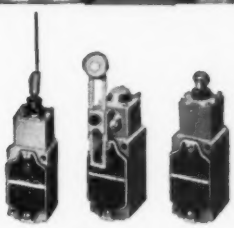
... Insist on Allen-Bradley accessories for continuous automatic production



In this broad line of Allen-Bradley accessories, each and every unit carries the traditional A-B trademark of *quality* that stands for trouble free operation. Rugged construction, and maintenance free, silver alloy contacts provide the reliability that is essential to the continuous operation of *your* automatic production machines.

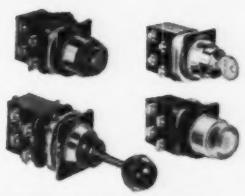
Profit from the experience of the leading machine tool builders . . . insist on Allen-Bradley *quality* motor control *all the way!*

Special push button panels can be assembled to your specifications.

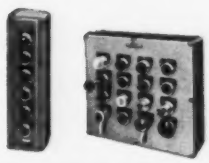


OILTIGHT LIMIT SWITCH
Bulletin 802T with sealed heads and bodies. Various operators.

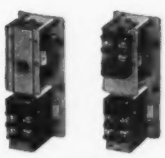
PRECISION LIMIT SWITCH
Bulletin 802 oiltight. Responds to very small operator travel.



OILTIGHT CONTROL UNITS
Bulletin 800T. Choice of push buttons, lights, and switches.



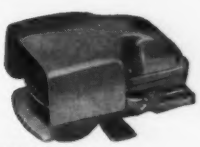
OILTIGHT CONTROL STATIONS
Bulletin 800T for up to 16 units in die cast aluminum enclosure.



PNEUMATIC TIMERS
Bulletin 849. Reliable and accurate. For on-delay or off-delay.

OILTIGHT PRESSURE CONTROL
Bulletin 836. For hydraulic systems with pressures to 5000 psi.

STANDARD DUTY PUSH BUTTONS
Bulletin 800. Up to three units, also pilot lights and switches.



FOOT SWITCH
Bulletin 805. In rugged die cast housing for toughest service.

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

Allen-Bradley Co., 216 W. Greenfield Ave., Milwaukee 4, Wisconsin. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ASK ME ANOTHER

Does aluminum conduit cost more than galvanized steel conduit?

No sir! Aluminum conduit can be purchased at approximately the same price as galvanized steel conduit.

For complete price information on aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.

KAISER ALUMINUM

Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, Oakland 12, Calif.

NO PLACE TO GAMBLE

Joints on steel plant water line are TAPECOATED to provide protection equivalent to coating on the pipe.

TAPECOAT® *is Your Best Bet to Protect Lines in Underground Service*

You take no chances when you specify TAPECOAT coal tar coating in handy tape form for pipe, pipe joints, fittings, couplings, tanks, tie rods, and conduit on new construction or for maintenance.

Since 1941, TAPECOAT has proved its superiority in resisting moisture, acids, alkalis, and other severe corrosive and abrasive conditions.

TAPECOAT comes in rolls of 2″, 3″, 4″, 6″, 18″ and 24″ widths. It is easy to apply with the use of a torch to bleed the coating which serves as both bond and protection. No skilled help required.

A TAPECOAT sales and service engineer is ready to help you on any corrosion problem. Write for details today.

Originators of Coal Tar Coating in Tape Form

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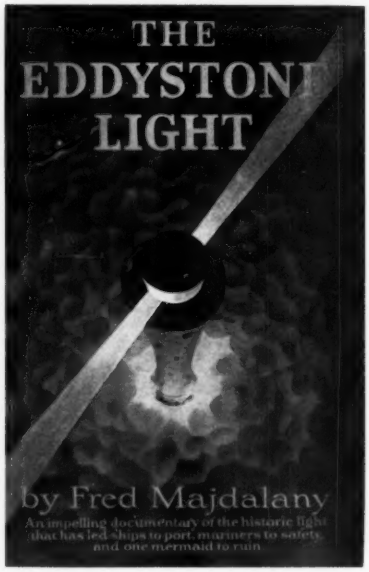
Navy, it had gotten its full share, and more, of the growing English Mercantile trade by the latter part of the 17th century. But the Eddystone Reef took a heavy toll of both

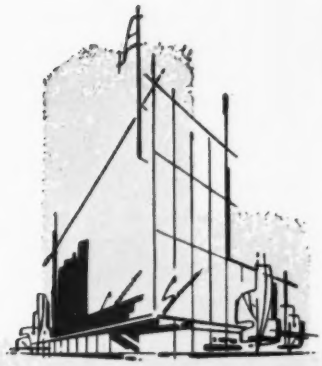

THE
EDDYSTONE
LIGHT
by Fred Majdalany
An impelling documentary of the historic fight that has led ships to port, mariners to safety and one mermaid to ruin

ships and men. Thus, it was pressure from Plymouth that finally forced the issue of building a lighthouse on the Reef.

From this point, Fred Majdalany's story makes exciting reading for engineer and layman alike. For it begins not with the famous Sir Christopher Wren, but rather with Henry Winstanley, Gent, keeper of a fun house. Since there were no civil engineers, as we know them now, Winstanley's only claim to competence was a remarkably ingenious house of mechanical wonders — open to the public at a shilling per head. Yet, his little stone lighthouse withstood the ravages of the sea from 1699 until 1703 when both Winstanley and his light were carried away in a storm more devastating than any ever recorded in the area. Six years elapsed before John Rudyard's wood sheathed stone tower was built, and it survived until 1755, when a fire destroyed it.

By this time, the engineer was beginning to be recognized, and

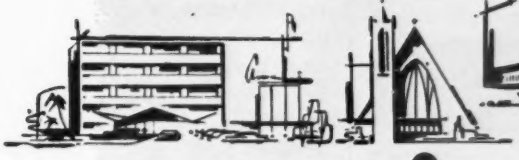
Curtis cools



RETAIL STORES & SUPERMARKETS

INDUSTRIAL PLANTS & HOSPITALS

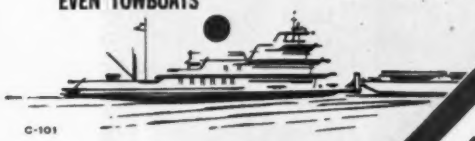
OFFICE & APARTMENT BUILDINGS



HOTELS & MOTELS BANKS & CHURCHES

etc.

EVEN TOWBOATS



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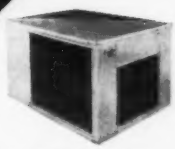
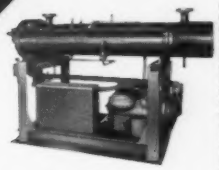


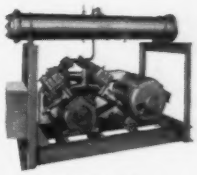
Packaged Air Cooled Conditioning Units 3 thru 10 Tons

Packaged Air Conditioning Units 3 thru 60 Tons



Packaged Liquid Chillers 7½ thru 125 Tons

Matching Evaporative Condensers, Cooling Towers and Air Handling Units



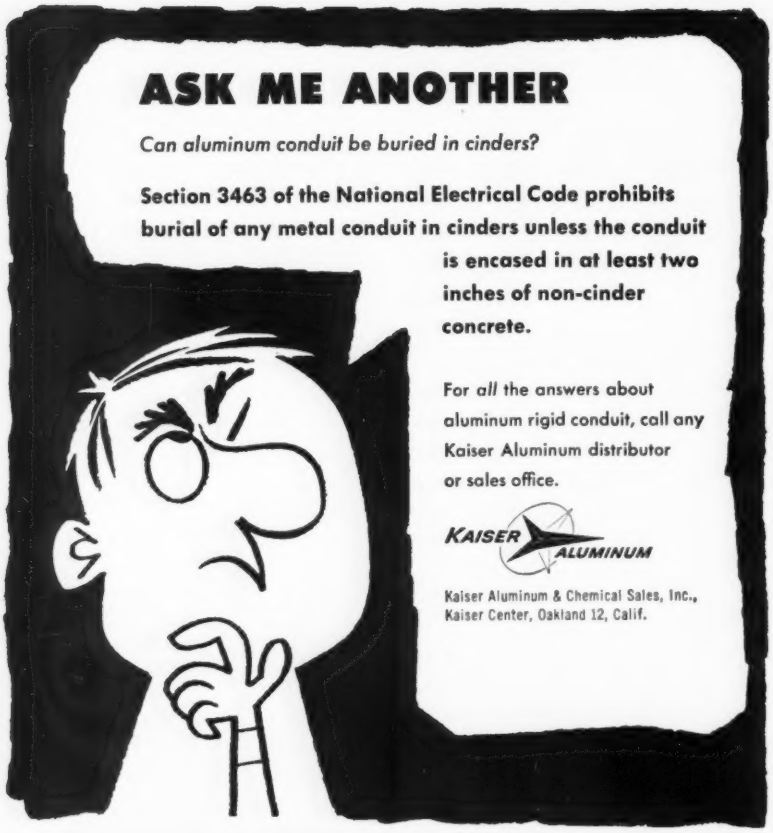
Condensing Units 3 thru 100 Tons

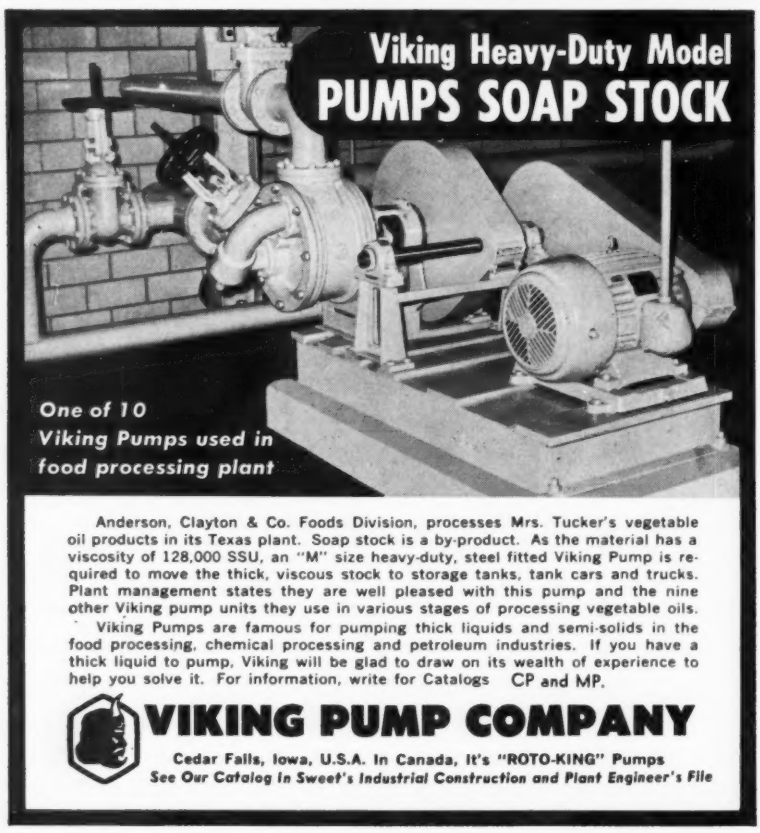
And in all applications—Curtis units perform dependably, always up to and frequently surpassing rated capacity. Key thing to remember is this . . . Curtis manufactures a complete line of units ideally suited to any application facing the engineer or mechanical contractor. Space saving, versatile Curtis equipment delivers dependable performance in installations of all types . . . and you will find the cost very much in line. This equipment allows for easy installation and servicing.

THE COMPLETE LINE OF LIQUID CHILLERS • PACKAGED AIR CONDITIONERS • CONDENSING UNITS

Curtis *Established 1854*

MANUFACTURING COMPANY • REFRIGERATION DIVISION • ***Dept. 3, St. Louis 33, Missouri***


ASK ME ANOTHER
Can aluminum conduit be buried in cinders?
Section 3463 of the National Electrical Code prohibits burial of any metal conduit in cinders unless the conduit is encased in at least two inches of non-cinder concrete.
For all the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.
KAISER ALUMINUM
Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, Oakland 12, Calif.


Viking Heavy-Duty Model
PUMPS SOAP STOCK
One of 10 Viking Pumps used in food processing plant
Anderson, Clayton & Co. Foods Division, processes Mrs. Tucker's vegetable oil products in its Texas plant. Soap stock is a by-product. As the material has a viscosity of 128,000 SSU, an "M" size heavy-duty, steel fitted Viking Pump is required to move the thick, viscous stock to storage tanks, tank cars and trucks. Plant management states they are well pleased with this pump and the nine other Viking pump units they use in various stages of processing vegetable oils.
Viking Pumps are famous for pumping thick liquids and semi-solids in the food processing, chemical processing and petroleum industries. If you have a thick liquid to pump, Viking will be glad to draw on its wealth of experience to help you solve it. For information, write for Catalogs CP and MP.
VIKING PUMP COMPANY
Cedar Falls, Iowa, U.S.A. In Canada, It's "ROTO-KING" Pumps
See Our Catalog in Sweet's Industrial Construction and Plant Engineer's File

the next man to tackle the Eddystone was John Smeaton. It is to the credit of the profession that he built extremely well. His interlocked stone structure was completed in 1759, and when it was finally torn down after the completion of a new and larger tower, it was not because Smeaton had failed, but because the rock on which he built had been undermined by the sea. The present light, completed by James Douglass in 1882 promises many more years of service, for Douglass was able to draw on the experiences of his predecessors on the Reef. In addition, his father was one of the leading lighthouse engineers of the day, and he was born and bred to the task.

Majdalany's story of the Eddystone Reef is extremely well told, not only in terms of the engineering achievements of the men who lit it, but also in terms of simple human courage and perseverance. For even today, only 5 out of 12 of the regularly scheduled relief landings at the light are completed on the intended day. And it was not until 1959 that the Eddystone Light was lit by electricity, when three small motor-generator sets were installed. The light now throws a 570,000 candle-power beam across the angry waters — a far cry from the 24 tallow candles that sputtered in the little tower of Henry Winstanley, Gent.

•

American Building Art: The Nineteenth Century, by Carl W. Condit, Oxford University Press, Fairlawn, N. J.; $12.50.

A number of informative and even dramatic histories of the building art have been written. Professor Condit, historian at Northwestern University, has now written what the historians call "a definitive study." His book represents years of painstaking, conscientious research and writing measuring up to high standards of scholarship. Fortunately Oxford University

Anyone can Claim to Meet the RLM Standards for Uniform Quality

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unbiased proof of conformance can only be had through repetitive tests by an independent laboratory such as is guaranteed by manufacturers offering RLM-LABELED LIGHTING EQUIPMENT

When a buyer takes delivery on incandescent, fluorescent or mercury lighting equipment he has a right to expect that every fixture will meet his specifications in all respects.

With RLM-Labeled equipment uniform quality is guaranteed by the manufacturer . . . as well as by the RLM testing and certification program. This program is conducted by the world-famous independent testing organization, The Electrical Testing Laboratories of New York and hence represents the most modern testing program in the lighting industry. Under this program it is not enough that certain samples meet RLM Standards. *Every fixture* to which the manufacturer affixes a RLM Label is warranteed by the manufacturer to meet applicable RLM Specifications.

Here you have one reason why there can be no such thing as a "RLM type" fixture . . . Either *it is RLM* with its testing and certification programs to guarantee uniform quality and high standards . . . *or it is NOT RLM!*

THE FINAL INGREDIENT OF BEING SURE

ETL Sphere Test used to determine overall efficiency of RLM incandescent lighting units.

These TWIN QQ's to Industrial Lighting Success are guaranteed with all lighting equipment bearing the RLM Label. Again there are new and upward Revised Standards for 1960. Mail coupon today.

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Please send free copy of the new "TWIN QQ" Pamphlet, the 1960 RLM SPECIFICATIONS BOOK and names of 22 leading manufacturers offering RLM-Labeled lighting equipment. (Please write name, company and address in margin below.)

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ASK ME ANOTHER

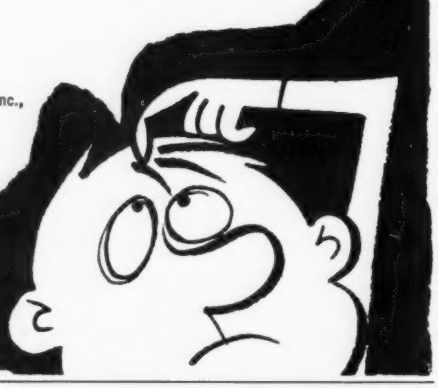
Is aluminum conduit easy to store?

Easier to store than steel—because you don't have to worry about corrosion or rust clogging aluminum threads. Also, due to its light weight it is much easier to handle, lift and carry. Keep caps on to exclude dirt and threads will be clean at any time you're ready to use the conduit.

For *all* the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.

KAISER ALUMINUM

Kaiser Aluminum & Chemical Sales, Inc.,
Kaiser Center, Oakland 12, Calif.



in laying out your client's plant

ARE YOU GUARDING AGAINST DUST DAMAGE TO MACHINES?

Will there be dust-producing machines in your client's new plant? Such as metalworking, wood-working or penumatic conveying equipment? If so, you should plan now for dust control.

Because dust clogs and gums up costly machinery, lowers production efficiency, causes breakdowns and higher maintenance costs. In addition, dust is harmful to the health of employees.

More and more professional men, laying out new plants and remodeling older ones, are specifying Torit Dust Collectors. Torit Dust Collectors have proved 98% efficient in removing dust. They are compact, easy to install and maintain, and cost far less than many types of dust collecting equipment.

Contact a Torit representative. He will give you dust collector specifications, performance charts, dimensional drawings, installation suggestions . . . all the information you need.

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Cyclone model. *Also available in portable cabinet models.*

Press has recognized the worth of Condit's study by publishing a handsome, profusely illustrated, volume.

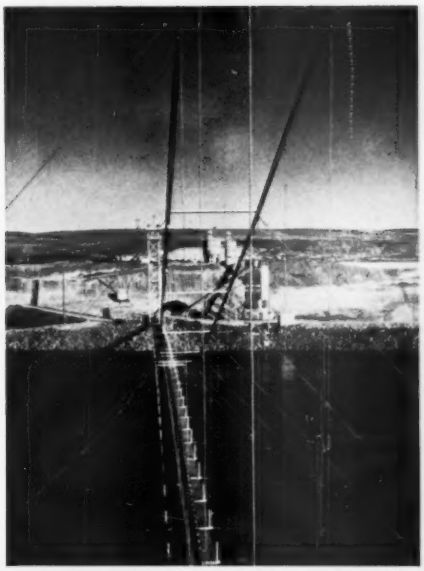
Professor Condit has broken his study down into sections dealing with wood and iron framing; wooden and iron bridge trusses; suspension and iron arch bridges; the railway trainshed; and concrete construction. Within these sections he chronologically presents descriptions of the outstanding works of 19th century builders. The material is frequently technical and descriptive, but the illustrations and the excellent explanatory notes help to carry the reader through the more difficult passages.

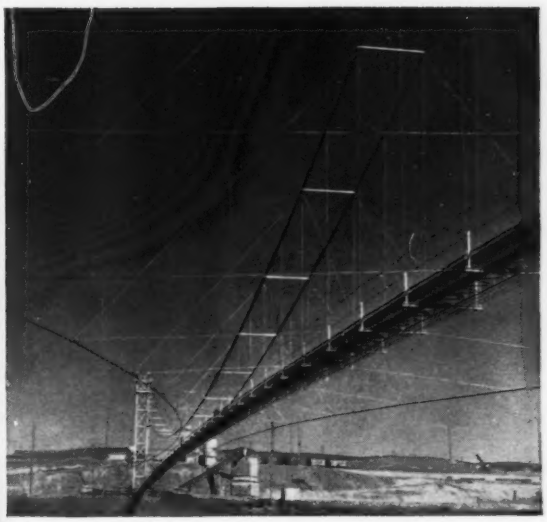
Although Condit has emphasized the descriptive aspect of his subject, his interpretive powers and writing ability are demonstrated in numerous passages, and especially in his introduction and conclusion. In the introduction the author argues that the 19th century witnessed the transformation of building from an empirical and pragmatic art to a science, and that the outstanding characteristic of the period was the rise of iron and concrete. He allows that the American builders frequently borrowed their forms and techniques from Europe, but he maintains that the strength of the American art lay in proliferation and multifarious modification.

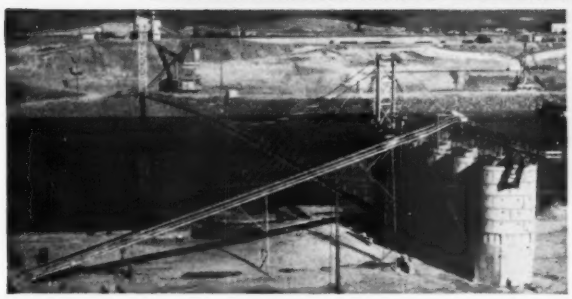
A historian of technology, Condit draws conclusions about this field from his studies. Building, he believes, like other technologies, has not been a sequence of inventions (archetypes) but a series of mutations and radiating modifications (most inventors would probably agree). He also stresses the debt of the applied art-science of building to mathematical analysis, predictive studies, and pragmatic, selective testing.

Condit hopes to prepare another volume on 20th century American building. It is probable that his current volume on the 19th century not only will be recognized as a

HOW TO SAVE TIME, MONEY AND MILES WHEN YOU BUILD A DAM







use a Roebling Conveyor Suspension Bridge

The sole purpose of this 1000-foot span, Roebling designed suspension system is to support an aggregate-carrying conveyor. The site is the Ice Harbor Lock and Dam Project at Pasco, Washington, under construction by Guy F. Atkinson Company.

The problem, and it was a large one, was to get the concrete aggregate from the South side of the river to the North side, without having to truck it some 10 miles around. The tremendous amount of concrete needed for the pouring of the dam's locks fully justified the erection of this structure. The savings in time and labor, and the assurance of an uninterrupted flow of material are additional factors that add to its value.

Of course, you don't have to build a dam before a Roebling conveyor *suspension* system can be of value to you. Your needs may be considerably more modest. You may have an in-plant (or "in-and out-plant") materials handling problem. It may be temporary or permanent.

No matter. Roebling designed and constructed suspension systems of all kinds are easing transportation problems for manufacturers and processors with speed, safety and savings. Don't think for a minute that your problem must be of the above magnitude. On the other hand, your needs may be greater. Either way—to carry your conveyor across the yard, or river, or between mountains—a Roebling suspension system can be the most economical answer. For details about your requirements, just ask Roebling's Bridge Division, Trenton 2, New Jersey.

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ASK ME ANOTHER

How does aluminum compare with steel on a strength basis; and is conduit ever figured as a component of concrete strength as reinforcing in concrete columns or slabs?

Steel has 51,000 psi ultimate strength and 20% elongation. Aluminum has about 22,000 psi and 20% elongation—more than enough strength to dependably protect enclosed conductors. Conduit is definitely not figured as a component of strength in concrete reinforcing.

For *all* the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.

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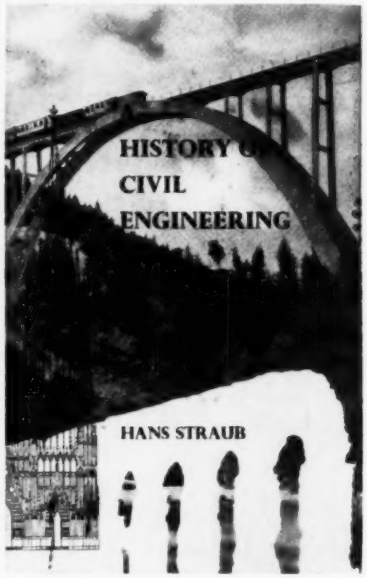
scholarly contribution, but also will appear as a status symbol on the desks of many civil engineers.

•

A History of Civil Engineering, by Hans Straub, translated by E. Rockwell; Charles T. Branford Company, Newton, Mass.; $5.00.

From the Appian Way to the Twentieth Century tollroad is a long journey through time for just 258 pages. But however lightly he has been forced to travel, Hans Straub does an excellent job in this book. His avowed intent has been to show the emergence of modern civil engineering from its twin origins – building craft and exact science.

In accomplishing his objective, Straub has unfortunately been



forced to give his readers some rather colorless sketches of such men as Leonardo, Galileo, and Hooke. However, his is a technical rather than personal history, and he does a good job of tracing the origins of the theory of the strength of materials and their subsequent use in structural analysis.

Philosophically, Straub is committed to what he calls creative

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NAYLOR Spiralweld pipe and Wedgelock couplings work together to save you time, effort and money for lines in construction service.

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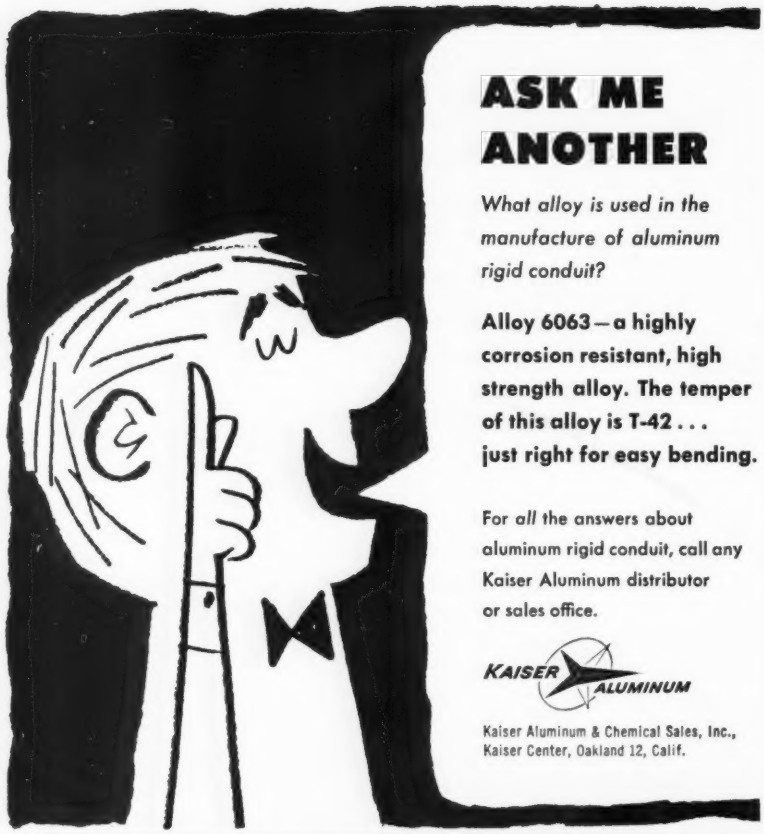

ASK ME ANOTHER

What alloy is used in the manufacture of aluminum rigid conduit?

Alloy 6063—a highly corrosion resistant, high strength alloy. The temper of this alloy is T-42 . . . just right for easy bending.

For *all* the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.

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design. His ideal is Robert Maillart, the Swiss engineer, who was concerned mainly with primary stresses in his analysis of a structure because of his belief that "any calculation can be nothing but a guidance to the designer." Thus, creation rather than calculation, according to Straub, is the goal of the modern civil engineer. If this is so, there are only a few who can qualify — and among them must surely be Nervi, Torroja, and Candella.

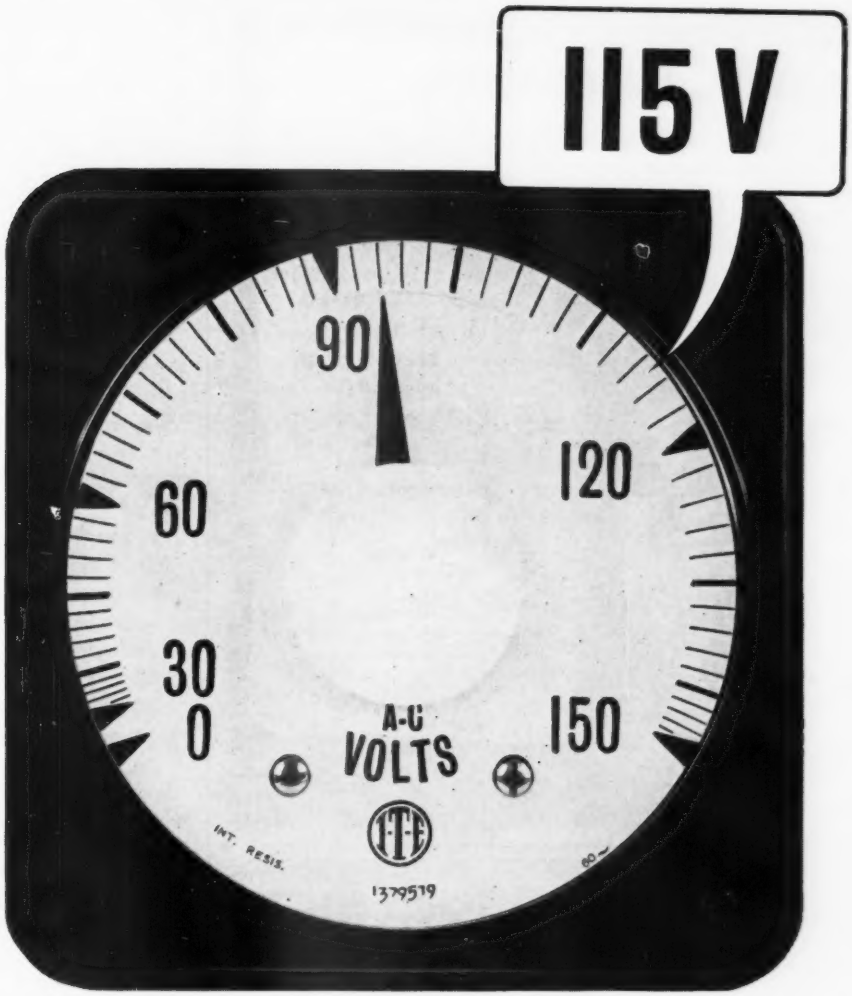
•

New Technical Books

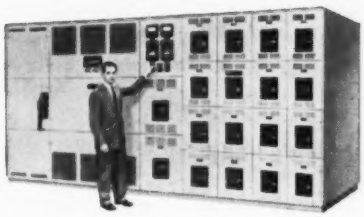
THE SCIENTIFIC PAPERS OF G. I. TAYLOR, Vol. II, edited by G. K. Batchelor; Cambridge University Press, New York, N. Y.; $14.50. This is the first of three volumes of Taylor's work on the mechanics of fluids, and contains papers on meteorology, oceanography, and turbulent flow. The book will be of particular interest to meteorologists, oceanographers, and geophysicists, but also will appeal to anyone interested in fluid mechanics in general, and with turbulent flow in particular. Papers by Taylor which are republished in this volume date from the early 1900s to as late as 1958.

PLANNING YOUR SCHOOL DOLLAR, by Carl H. Stautz; Chilton Company, Philadelphia, Pa.; $2.75. Although written for the school board member and the interested citizen, this book is important to consulting engineers in inter-professional practice. Once again, it emphasizes the all too obvious fact that the consulting engineer goes unrecognized in a field where his talents play a role of rapidly growing importance.

The need for schools continues to rise, and so does the need for structural, electrical, and mechanical engineering services in their design. Yet here is a book, published in 1960 by an author who is reputed to be an authority, which seems totally unaware of the func-

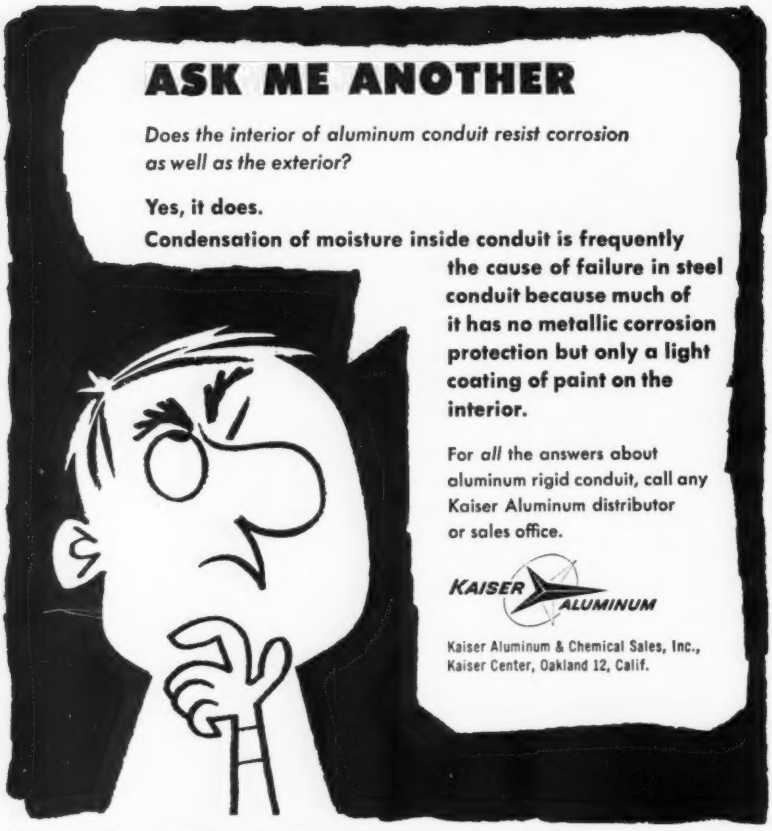


"But I was positive we didn't need another substation!"



MORAL: For good voltage regulation and better operating efficiency, put a secondary unit substation in each load area. And for complete information on today's most value-packed line of substations, write for Bulletin 3104-1A, I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton Street, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY


ASK ME ANOTHER
Does the interior of aluminum conduit resist corrosion as well as the exterior?
Yes, it does.
Condensation of moisture inside conduit is frequently the cause of failure in steel conduit because much of it has no metallic corrosion protection but only a light coating of paint on the interior.
For all the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.
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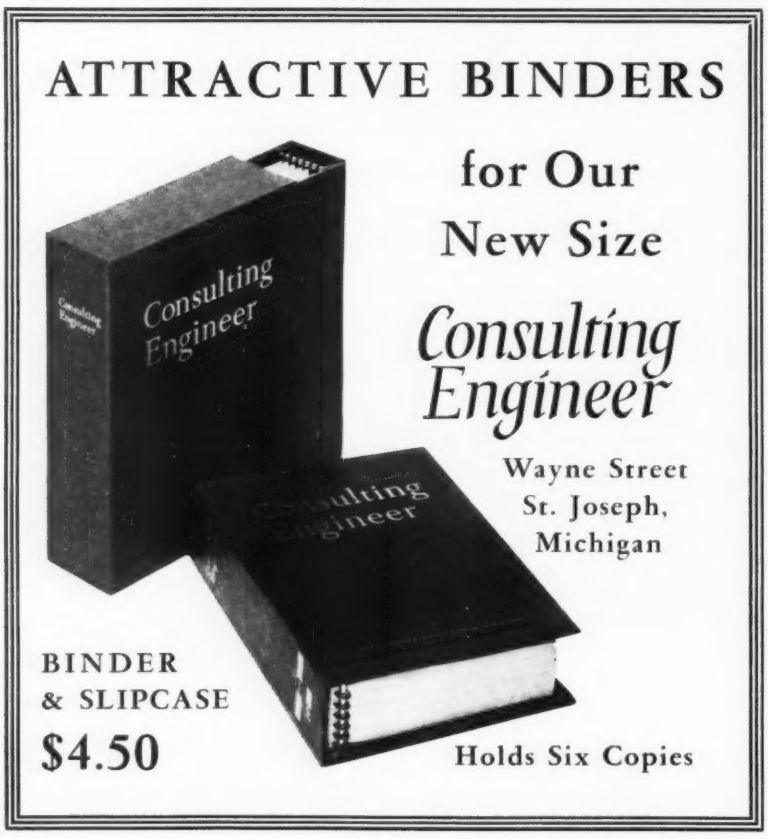
Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, Oakland 12, Calif.



tion of the consulting engineer. It is about time that school boards became aware of the consulting engineer and the fact that his work may account for as high as 50 percent of the total costs in school construction. The book is well worth reading if its only effect is to aggravate a few consulting engineers into making their function known to the nation's school boards.

PROGRESS IN DIELECTRICS, Vol. I, edited by J. B. Birks and J. H. Schulman; John Wiley & Sons, Inc., New York, N. Y.; $11.00. This is the first volume in what is intended to be an annual series designed to coordinate current knowledge of dielectric phenomena, materials, and techniques. Recent progress in different aspects of the subject are reviewed and the material will be of interest to consulting engineers in electrical and electronic fields. Dielectric breakdown in solid insulation and its effects in crystals is covered as well as liquid and gaseous dielectrics, ferroelectricity, nonoxide ceramic dielectrics, and electrophoretic deposition.

NUCLEAR TECHNOLOGY FOR ENGINEERS, by R. Hobart Ellis, Jr.; McGraw-Hill, New York, N. Y.; $9.50. Here is a basic guide to the four major areas of nuclear engineering – radiotracer technology, radiation, fission energy, and nuclear fusion. The book includes a concise explanation of the structure of the atomic nucleus and the ways in which unstable nuclei disintegrate to produce rays of particles and protons. The discussion of how modern technology makes use of these is based on the limited use of mathematics. It is, by intent, an introduction to nuclear technology, and is therefore of interest to those engineers requiring general background or a good foundation for further study.

PRINCIPLES OF ENGINEERING ECONOMY, by Eugene I. Grant and W.

when new
building
heights
are reached

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provide the first direct discharge design for removing foul air, quietly!*

High-up in engineering performance and low silhouette design are Penn's Domex Roof Exhausters featuring the *first spun-aluminum housing with direct scroll discharge that reduces turbulence while increasing air flow!

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ASK ME ANOTHER

If the cost of aluminum and steel conduit is about the same, why should I use aluminum?

One of the most important reasons for using aluminum conduit is ease of handling and erection. The big cost factor in most conduit installations is labor rather than material. Lightweight aluminum saves man-hours—up to 50% in large conduit sizes.

For *all* the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.

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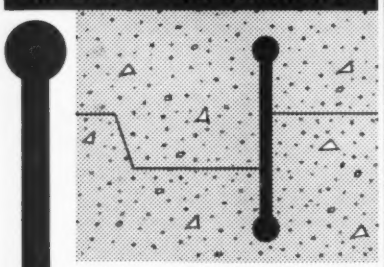
WATERSTOPS
FOR MASONRY CONSTRUCTION JOINTS



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Williams Efficiency Waterstops are made from Natural Rubber Stock, and designed for maximum effectiveness in any type of cast-in-place construction joint. They will bend around corners—will not crack or tear from shear action. Tensile Test: 3990 lbs.; Elongation Test: 650%. Available in rolls up to 80 feet in length. Field splicing is simple. Williams Waterstops can also be furnished in Vinyl or Neoprene for industrial uses where resistance to oil and other injurious wastes is desirable. These highly effective Waterstops are now in use in hundreds of industrial plants, commercial and public buildings throughout the country.

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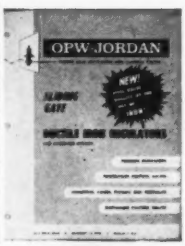

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Grant Ireson; The Ronald Press Company, New York, N. Y.; $8.00. In its fourth edition, this standard text has been completely revamped and many new features added. Among these are emphasis on the importance of income tax considerations in investment decisions, practical reasons for avoiding unsound criteria such as "pay-off periods" in evaluating investment proposals, and continuous stress on use of the "discounted cash flow" theory. The appendix includes many new tables and the most recent method developed by the Machinery and Allied Products Institute for analyzing proposed replacements.

STRUCTURAL ENGINEERING, edited by Nathan S. Glassman and Harry H. Graef; International Business Services, Washington, D. C.; $7.50. First used as a work book at the University of Virginia, this ring bound volume now is being made available generally as a data and work book. Its primary purpose was to prepare architects for professional registration, but it also may serve as a useful reference for young engineers because of its good collection of practical design problems.

A STUDY TO IMPROVE BITUMINOUS BUILT-UP ROOFS; Building Research Institute, Washington, D. C.; $1.50. This monograph includes three papers covering a study of bituminous built-up roofs: "A Study to Improve Industrial Plant Roof Construction," "A Theory of the Mechanism of Blistering," and "Summary of Laboratory Studies."

ROUTE SURVEYS AND DESIGN, by Thomas F. Hickerson; McGraw-Hill Book Co., New York, N. Y.; $8.50. In its fourth edition, this well known work has been revised completely to bring it into accord with the rapid developments in photogrammetry and electronics. Much new material on treatment of curves has been added. ▲▲

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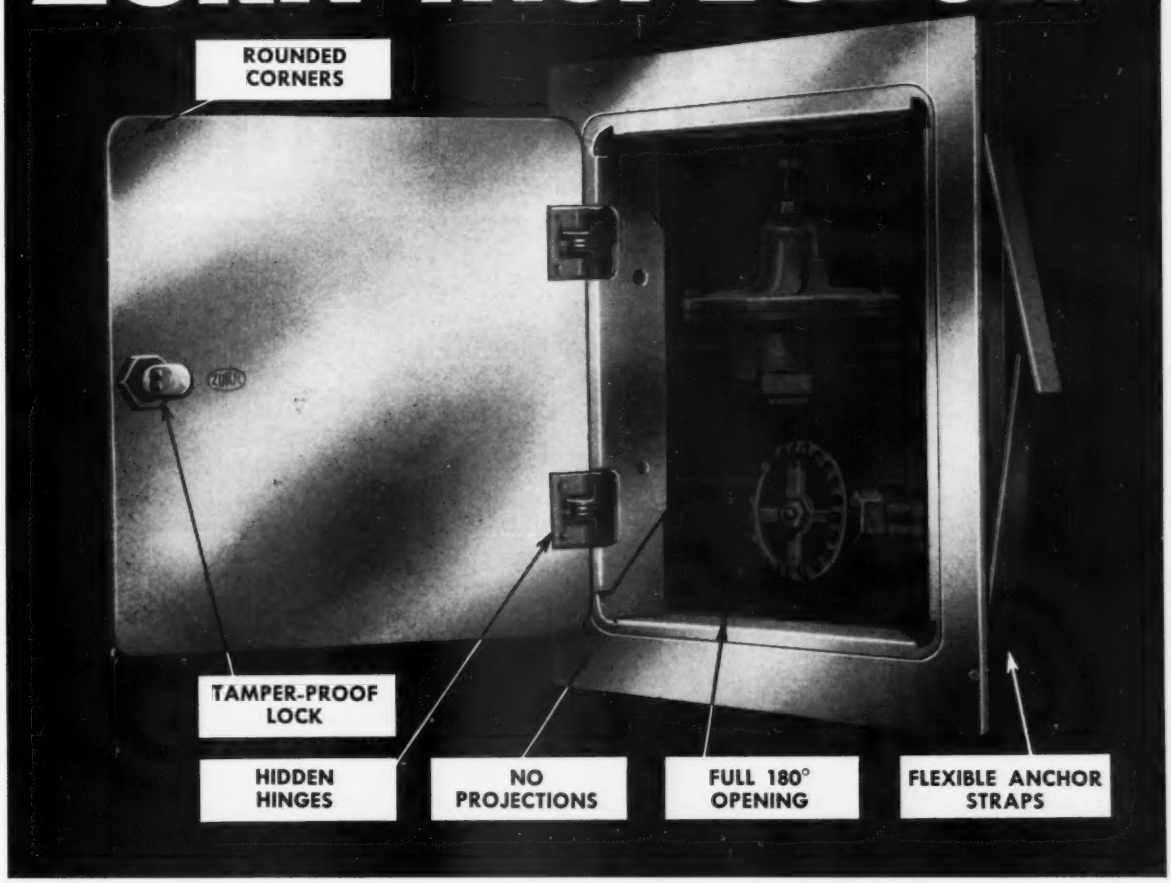

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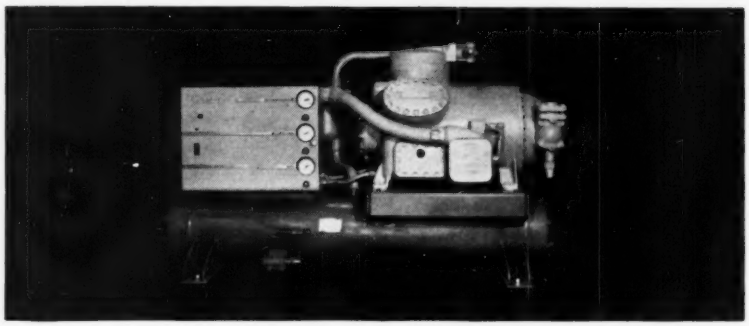

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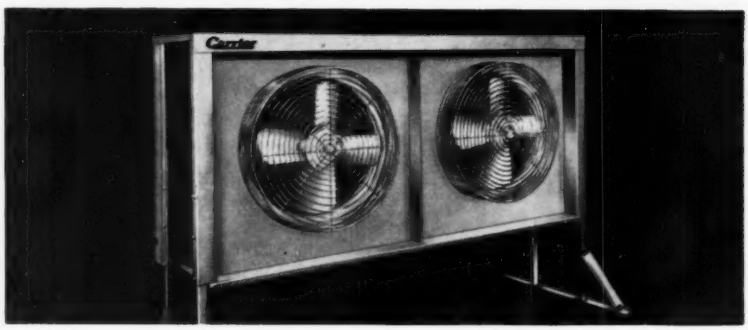

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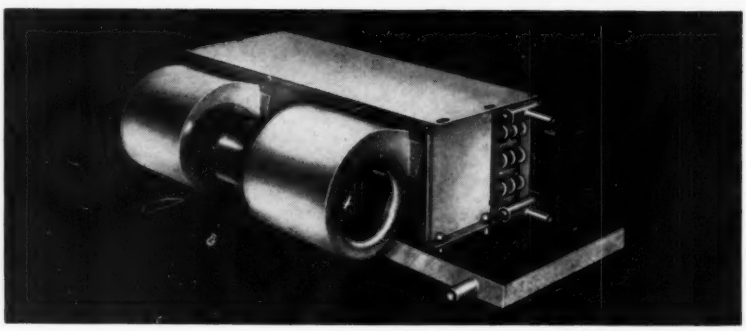

For complete details about these new products, see the Carrier dealer listed in the Yellow Pages. Or write Carrier Corporation, Syracuse 1, New York.

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FIELD NOTES

How the United Nations Hires Consulting Engineers

MARJORIE ODEN, Eastern Editor

MANY UNITED STATES consulting engineers seem to be overlooking a good source for foreign projects. The United Nations has two programs using the services of consultants. Although future possibilities and fringe benefits of such projects are more attractive than are the current fees, it might pay U. S. consultants to see that their names are added to the still small roster of available manpower.

The Canadian government's Foreign Trade Service, an aggressive group helping Canadian consultants get projects, thinks the UN offers sufficient opportunity to warrant a recent Trade Service sponsored trip to New York City for 40 Canadian consultants.

The Canadians, who also visited the World Bank in Washington, reported that the United Nations offers perhaps a greater opportunity for foreign work than does the World Bank. This could be true, if long-range benefits are included.

Many governments are interested enough in the United Nations programs to have established permanent committees to help find experts from their own country. The United States has indicated an interest by assigning an official of the State Department to work full time helping the United Nations groups and to aid in getting Americans appointed to the permanent UN staff.

Technical Assistance Only

The Expanded Program of Technical Assistance of the United Nations is under the coordination of the Technical Assistance Board. All member countries in the United Nations take part in this program, which offers expert assistance to any country on approval of their request. The program provides technical help to nations which already have decided on a project and need an expert in a specified field. Many of these projects require engineering background. Often, consulting jobs are relatively small, merely supplying an engineer to straighten out a problem which develops on some project.

The United Nations finances no construction of projects, leaving this to the International Cooperation Administration, or other government groups. "We supply the brains, fill in the gaps, for projects already under way," one UN official explained.

The biggest disadvantage to a consultant accepting a United Nations project is that he must be hired as an individual, and become a temporary employee of the United Nations during the course of the assignment. An officer of the Technical Assistance Recruitment Services of the United Nations explained that the United Nations likes to deal directly with the experts, and "the governments receiving the technical aid feel that a man on the United Nations staff will give more unbiased opinions. The men serve in advisory rather than executive posts. For example, engineers are asked to advise on design and planning problems rather than to carry out construction or operating tasks."

Individual Assignments Only

UN officials realize the handicap in hiring individuals rather than firms. They report that, "Many inquiries have been received from engineering and consulting firms who have felt that they could accomplish some of the Technical Assistance projects of the United Nations more efficiently than experts appointed in their individual capacity. The value of effective backstopping and teamwork provided by a consulting firm is fully appreciated. Nevertheless, the United Nations has only occasionally been able to make such con-

ZENITH

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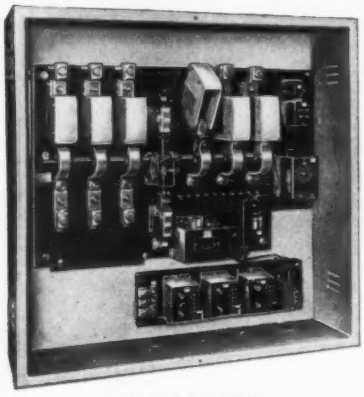
engineered to assure continuous power, safeguard life, property, production.



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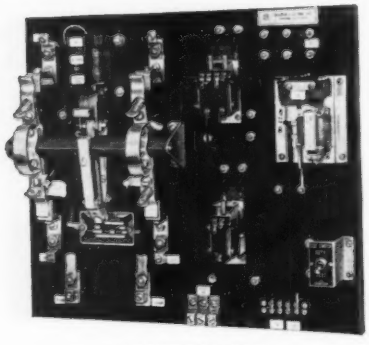

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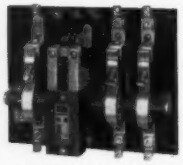

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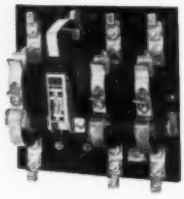

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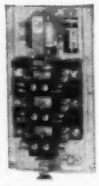

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tractual arrangements, since its program is rarely concerned with large-scale development projects but rather with the provision of specific expert advice at a given stage of a project. In some respects, too, the technical advice comes from an individual who is actually an official of the United Nations."

A UN brochure points out that, "There have been a few cases in which governments have specifically requested contractual arrangements with firms, and in these cases the United Nations has been glad to carry out the appropriate administrative arrangements."

Of course, there is a well recognized, but never mentioned, advantage of taking United Nations projects despite the drawbacks. A consulting engineer can make valuable contacts and learn the potential of a country while working on full salary in a prestige position.

The fees are so-so. Maximum base pay for a year is $12,500 – state and Federal tax free. With living allowances, this can go as high as $20,000. Also, the consultant is allowed to take his family on any assignment lasting one year or longer. Frequently, projects take longer than originally anticipated, and one assignment often leads to another if the consultant wants it. But many assignments are as short as six weeks.

New Program Underway

A newer program – the United Nations Special Fund – offers much more opportunity to the consultant. In the first place, the projects are much larger than those handled by TAB, and in the future it is possible that consulting firms will be retained under this program. The Special Fund, like the Expanded Program, is a continuing program supported by voluntary contributions from 85 nations. The International Atomic Energy Agency also is among the organizations cooperating in the effort.

As the UN explains it, "The Special Fund will concentrate on rel-

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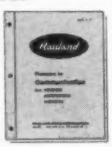
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atively large projects and avoid allocation of its resources over a great number of small projects. It is concerned with investment that will develop the economic activity of a country and a preliminary to any proposed investment is a survey of the economic potential of the country concerned, and preliminary engineering feasibility reports frequently will be required." Major stress to date has been on obtaining complete technical studies for large civil works projects using hydrological, forestry, and soil mechanics experts.

About $22 million has been allocated for experts' fees on the Special Fund program as a beginning. However, it includes allocations for many kinds of experts other than engineers.

Personnel Selection

How does the United Nations select consultants? To begin with, the UN makes recommendations only – no final selections. On any project, the United Nations tries to submit the names of several candidates (preferably from different countries) to the nation requesting assistance. The final choice is made by the government involved.

New York City is the headquarters for United Nations Technical Assistance recruitment and also the center for North American recruitment. The United Nations Technical Assistance Recruitment Services also maintains another permanent office in Paris, and has field interviewers elsewhere.

It is not usually necessary, but preferable, for a consulting engineer to speak the language of the country requesting technical aid. Most technicians speak French or English, and if there is any difficulty, the client country often provides an interpreter.

United Nations recruitment officers emphasize that the United Nations expert can be successful only if he is able to present his recommendations in such a way that they are acceptable to the government which he is advising. Of great importance is the ability to make recommendations that take into account the practical difficulties and the actual situation in the countries concerned. Also, governments almost invariably call for experts who have reached a high professional standing after long experience in their fields. Very few want specialists with less than 15 years experience.

United Nations officials emphasized that finding the men they need at the time they need them is not easy. The United Nations has a file of more than 10,000 technical specialists including a large percentage of engineers. All who have requested a listing are not registered engineers – or even engineers. However, careful screening is made before a project is given to a man. There are coding marks for the cards of a few applicants who are known to be not qualified, and other marks for those who are especially suitable.

Approximately three or four requests for technical aid per day are received by the United Nations, of which it fills about one a day. In an average week, three or four engineers stop by to ask about having their names added to the roster. However, building a list of experts is a slow process.

How to Apply

What should a consulting engineer who wants to be considered for future UN jobs do? Resumes should be submitted to the Technical Assistance Recruitment Services, Office of Personnel, United Nations, New York. Personal interviews are arranged later, if considered necessary. It was pointed out that to be listed on the roster implies no obligation on the part of the candidates to accept any particular assignment; it merely indicates a general interest. In some cases, experts whose names have been placed on it have been recruited for an assignment after a lapse of several years. ▲▲

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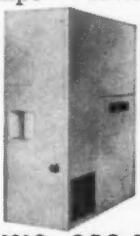

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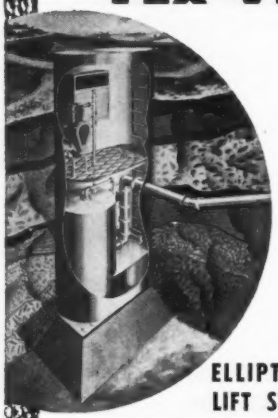

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Men in Engineering

Hugh P. Duffill, president of Duffill Associates, Inc., consulting engineers of Boston, Massachusetts, was elected a director of the American Shore & Beach Preservation Association at its recent meeting held at Pacific Palisades, California. The ASBPA has 167 members made up of Federal, state, and local government agencies, other organizations, and individuals interested in conservation development and restoration of shores and beaches.

Due to the untimely death of Adolf H. Koebig, Jr., the board of directors of Koebig and Koebig, consulting engineers of Los Angeles, met recently to elect a new director and new officers of the corporation. New officers are: president and chairman of the board, R. D. Spencer; vice president, operations, E. H. Graham, Jr.; vice president, administration, R. M. Wilkerson; and director, G. F. Smith.

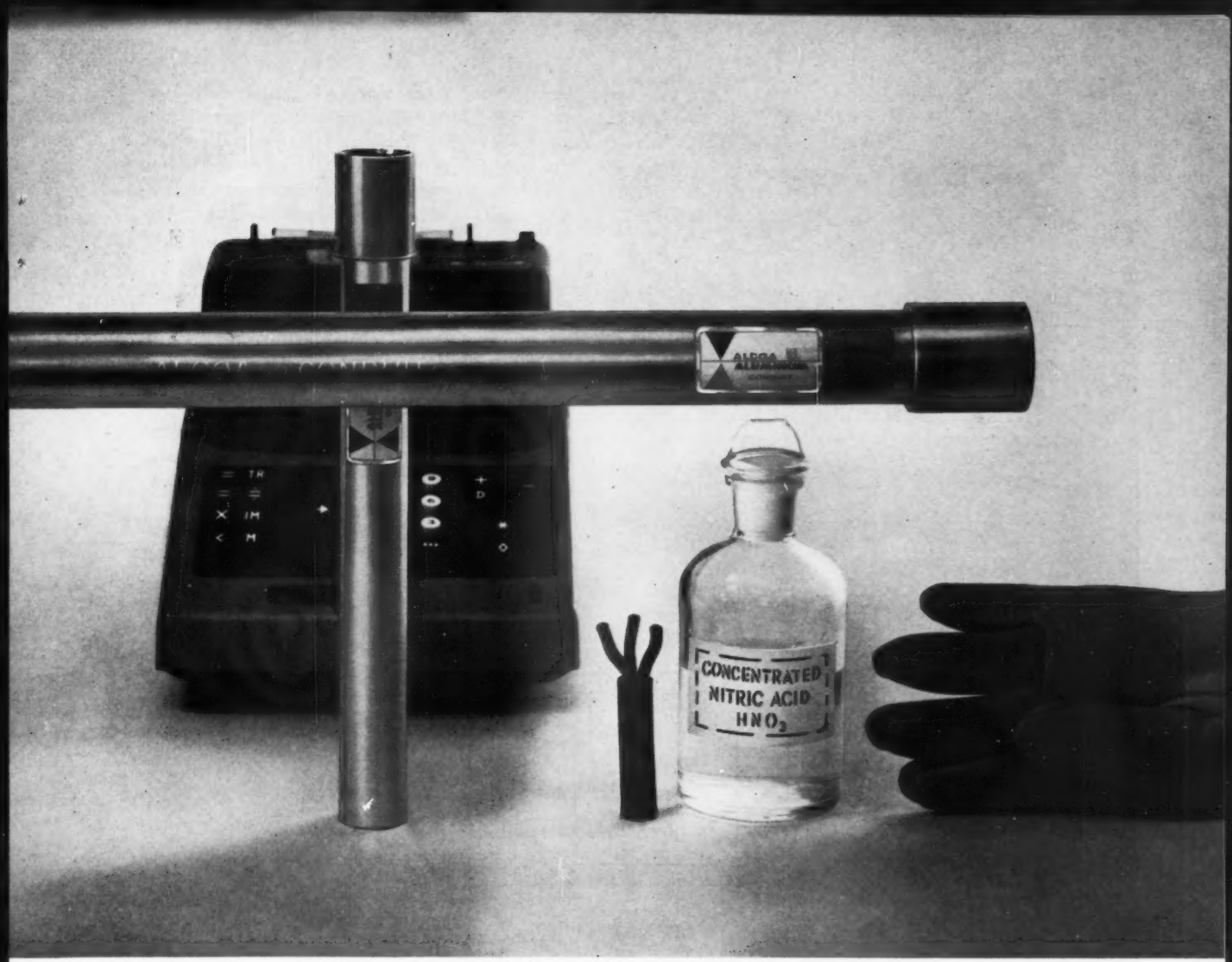
Roger F. Curry has become a partner in the firm of Cleverdon, Varney and Pike, consulting engineers of Boston, Massachusetts.

Voorhees Walker Smith Smith & Haines recently observed its 75th year of continuous practice. Founded in 1885 by Cyrus L. W. Eidlitz as a one-man concern, the firm has expanded through nine partnerships to the flourishing organization of 600 it is today. Always located in New York, the firm has had its main offices in the Architects' Building for 35 years. Since its inception it has completed over 5000 projects, encompassing every known building type.

An announcement has been made that Reg. F. Taylor has resumed his former consulting engineer practice at 3207 Montrose Boulevard, Houston, Texas.

TAYLOR SEVER

L. J. Sever, senior electrical engineer and associate, Albert Kahn Associated Architects and Engineers, won second place from among seven entrants in a Great Lakes Regional Lighting Contest held in May in Cleveland, Ohio. Sponsored by 11 sectional chapters of the Illuminating Engineering Society, the contest was conducted to select the outstanding lighting projects designed by members of IES, installation of which was completed in 1959. Sever's presentation described the lighting of the new National Bank of Detroit building, with emphasis on the main lobby, executive floors, general office areas, and the lounge, cafeteria, and auditorium on the staff floor. Objective of the



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Aluminum *saves* installation labor because it is light in weight. A 10-foot length of 4-inch conduit, for example, weighs only 34 pounds. A comparable section of conventional steel conduit weighs 98 pounds. This weight advantage is a big factor in all phases of handling. And nonsparking aluminum is easier to cut, bend and thread than steel.

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design throughout the bank building was to provide lighting of excellent quality and intensity to enhance architectural features and to insure optimum visual comfort.

Announcement has been made of the merger of the consulting engineering practice of C. D. Bassett with Cummins & Barnard, Inc., engineers, of Ann Arbor, Michigan. Bassett will serve as a vice president and director of Cummins & Barnard. Other owners are H. N. Barnard, R. J. Bowes, A. A. Cummins, R. W. Greenwood, J. H. Krick, C. F. North, F. Von Voigtlander, R. A. Sarri, and Hugh N. Barnard.

Raymond J Detmers and Richard R. Kingscott have been named project engineers in the mechanical engineering department of A. M. Kinney, Inc., consulting engineers of Cincinnati, Ohio. Detmers formerly was a job captain with Harley Ellington & Day, Inc., consulting engineers, Detroit, and has had extensive experience in the design of heating, ventilating, and air conditioning systems. Kingscott formerly was vice president and chief engineer of L. C. Kingscott & Associates, Kalamazoo, Michigan.

Robert T. Lawson, formerly a resident partner with Dames & Moore, San Francisco consulting engineers, has joined the staff of Harding Associates, soils engineering firm of San Rafael, California. Lawson, secretary of the San Francisco section of the American Society of Civil Engineers, has specialized in soils and foundation engineering throughout his career.

LAWSON WHITTELSEY

Charles C. Whittelsey, president of the consulting engineering firm of Ford, Bacon & Davis, Inc., New York, was presented an honorary degree of Doctor of Engineering by the School of Mines and Metallurgy of the University of Missouri at its 87th commencement ceremonies in May.

Peter Carver Associates have moved their office to 235 West 46th Street, New York, New York.

Emerson S. Marshall has been named a partner in the firm of T. Maseng & Associates, consulting engineers, Louisville, Kentucky. Marshall formerly was chief engineer in charge of power plant development, construction, and general plant engineering at the American Creosoting Corp.

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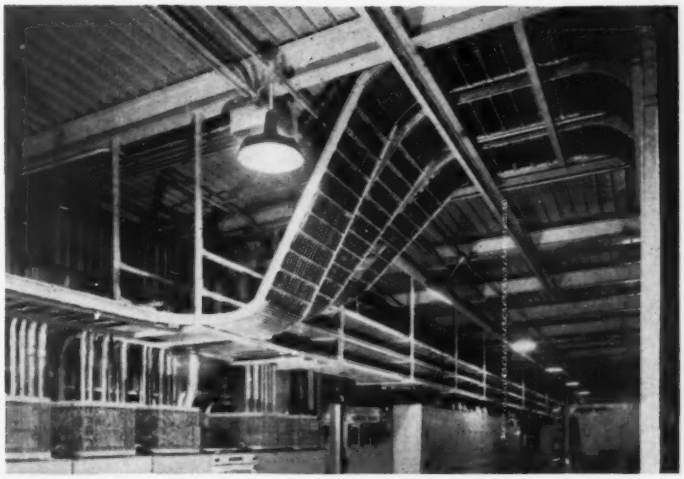

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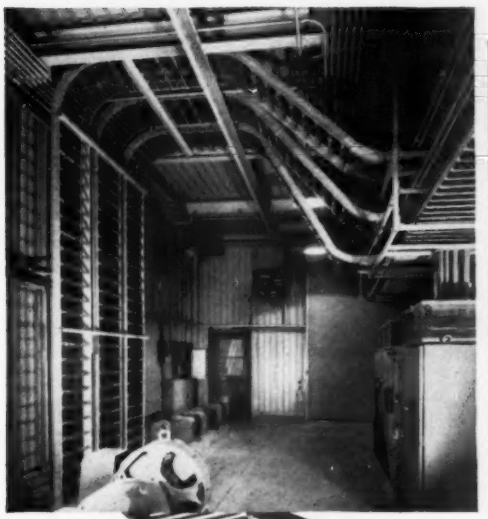

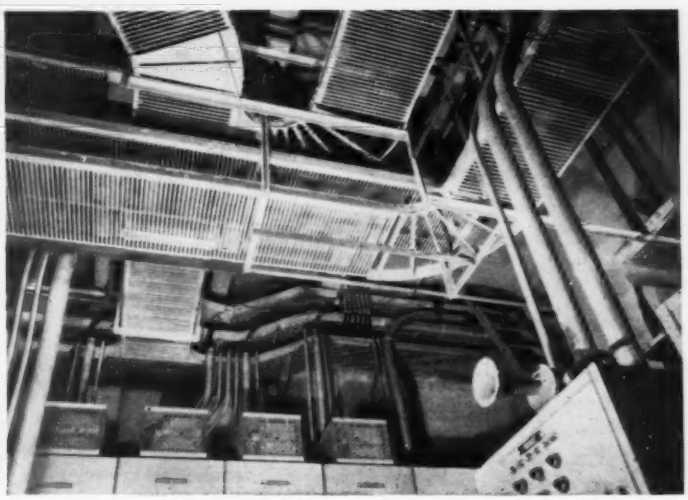

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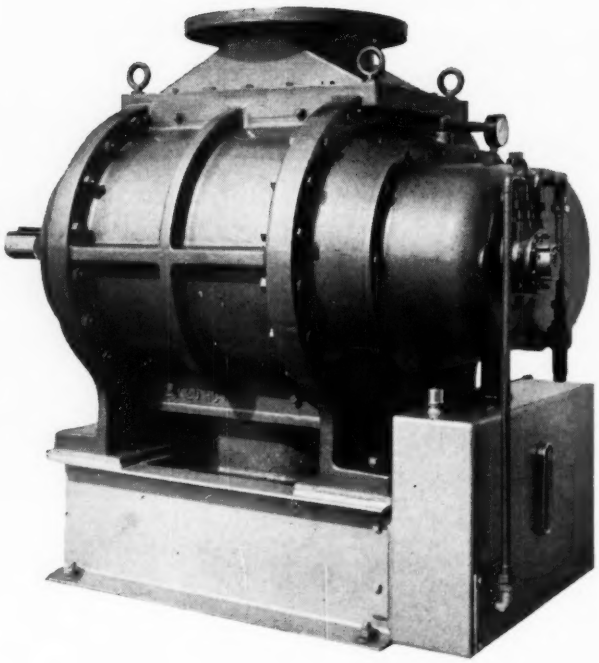

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Reporting

The New Projects

Heat Pump For Milwaukee Plant

George H. Volk, Milwaukee consulting engineer, has specified refrigeration equipment with 1400 tons of cooling capacity for use with a heat pump installation in the new eight-story headquarters and research center of the Allen-Bradley Company in Milwaukee. This system, being built by the Carrier Corporation, is larger by nearly 500 tons than the previous record-size system built by the company last year for a publishing plant in Indiana. It also will be the northernmost installation of this type of equipment in the country.

The balanced heat pump system will heat the entire building by extracting surplus heat from people, lights, and business machines in interior areas and transferring it to cooler offices located on the outer parts of the building. During warm weather the three centrifugal refrigerating machines will be used to cool the entire building. In winter they will cool some parts of the building and heat others, simultaneously. In addition they will warm up two 75,000 gallon tanks of water for heating the building during weekends and at night, when heat from other sources is not available. No boilers or other fuel-heating devices are required.

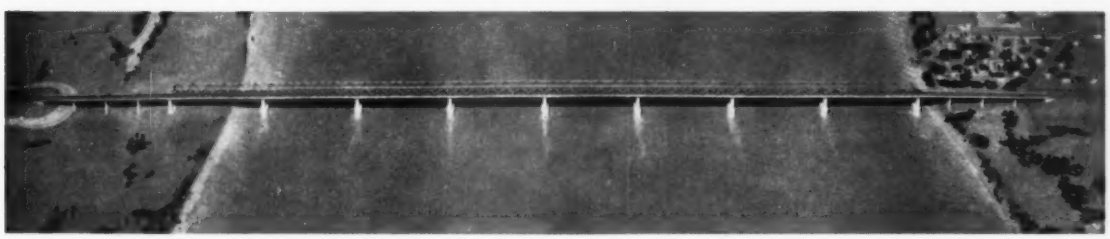
Mile Long Road Bridge on the Niger

The construction of a mile long road bridge across the Niger at a cost of approximately $15,750,000 will provide the first direct link between the Eastern and Western regions of Nigeria. The Taylor Woodrow civil engineering group in London has signed an agreement with the Federal government of Nigeria and will arrange for the financing of the project.

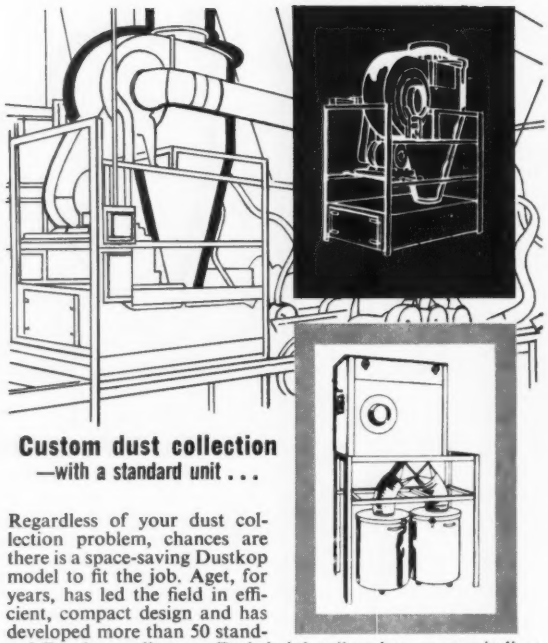
The new bridge will be located between Asaba, Western Region, and Onitsha, Eastern Region, and it is 400 miles away from the only other bridge across the Niger – at Jebba in the Northern Region. The plans call for a steel superstructure comprising 10 spans, each 427-ft long, carried on reinforced concrete piers and abutments. There will be two carriageways and foot paths, totaling 68 feet in width. Concrete plank decking and wearing surfaces will be provided. Approach roads and bridge spans will be constructed by Taylor Woodrow, and it is anticipated that the bridge will take over four years to complete. Consulting engineers for the project are NEDECO (Netherlands Engineering Consultants), of The Hague, Holland.

Pool Tops Manhattan Apartment

Gracie Towers, just being completed on Manhattan's east side, will reach new heights in luxury apartment house dwelling with a $100,000 swimming pool on its roof. The pool will be fabricated from steel by Koven Steel Swimming Pools, Inc. Although the first 20 stories of the building are reinforced concrete, the structural engineers, Weinberger, Frieman, Leichtman & Quinn, selected steel for the pool and pool supports because of the significant reduction in weight. On the basis of the structural engineer's studies, it was esti-



Almost $16 million will be spent on this 10-span, mile-long bridge connecting east and west Nigeria.



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mated that the filled 20′ x 40′ pool would be equivalent to adding 2½ stories to the building if designed in steel and 4 1/3 stories if designed in reinforced concrete.

The entire pool structure is chemically treated and painted for complete resistance to corrosion both inside and out. A complete change of filtered, chlorinated, and vacuum cleaned water every eight hours is to be provided by a purification system designed by Sears & Kopf, mechanical engineers. A separate equipment room will be located below the pool which will include the filtering, chlorinating, and cleaning facilities. In spring and fall the water will be maintained at a temperature of 75 to 80 F, and during the winter months the pool will be converted into an ice-skating rink.

Steel swimming pool atop apartment building is equivalent to adding 2½ stories to the structure.

Polarizing Light Panels Reduce Glare

Drafting rooms and other areas of the Georgia plant of Lockheed Aircraft Corporation have been equipped with Fiberglas polarizing light panels to reduce the fatigue of draftsmen. Combined with Day-Brite lighting fixtures equipped with 40-watt fluorescent lamps, the polarizing panels allowed an increase from 65 to 150 footcandles, while making significant reduction in both direct and reflected glare. Electrical engineer for the project was Walter H. West & Associates.

Sixth Gas Compressor for Long Beach

A new $2½ million gas compressor plant for the Long Beach Gas Department was dedicated on April 22. According to M. A. Nishkian & Company, Long Beach consulting engineers, the plant is the most highly automated of its type in the nation today. In addition, it features the world's largest Wiggins type gas holder. The main building contains four, 550-hp, gas engine driven, reciprocating

The new incinerator at Whitemarsh. Note the neat compact lines of the building and the low stacks of the wet scrubbers which emit only a plume of steam. Glace & Glace Inc. were consulting engineers for the project.

Only these four men are needed to operate the plant: One man to weigh incoming trucks and supervise unloading, a second to operate the conveyor, a third to load and drive the truck carrying away the non-combustible residue, and a supervisor.

Storage conveyor consists of two, 50-ton capacity oscillating hoppers placed side by side but independently controlled. Material is moved to feeders in a series of short reciprocating arcs. This action is self-scouring and keeps the storage trough completely clean.

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NEW PRINCIPLE INCINERATOR

eliminates mess and fumes—is economical to operate

Designed to burn 12½ tons of refuse *per hour* without odor or dirt, this new incinerator is in operation at Whitemarsh, Pa. In addition to garbage, tin cans, lawn trimmings and wastepaper, the incinerator handles undigested sludge from an adjacent sewage plant. Located in a residential section, plant exterior and landscaping are designed to harmonize with their surroundings.

The Dravo Incinerator has a number of unique features. Of primary significance are: the continuous flow design, which permits rapid and easy handling of the refuse; the water wall furnace, which permits the use of sufficiently high temperatures to provide thorough combustion and the elimination of noxious odors; and the wet scrubber and residue disposal system, which together promote the maintenance of healthful cleanliness.

Automatic operation has been stressed, only four men are required to run the entire plant. Present needs demand operation of the plant for only one 8-hour shift, but since it can be run on a 24-hour basis, there is adequate capacity for future needs.

The Dravo Incinerator is the economical solution to the problem of sanitary, convenient refuse disposal. For full information, write or call DRAVO CORPORATION, PITTSBURGH 22, PENNSYLVANIA.

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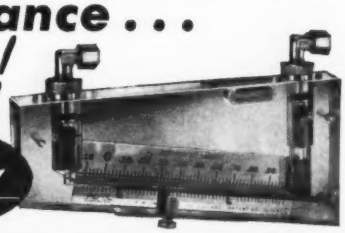
FILTER EFFICIENCY
at a glance . . . anytime!

Dwyer



AIR FILTER GAGE

With the Dwyer Air Filter Gage you can be sure of maximum filter efficiency because you know the *exact* time to replace filters, *every time.* Gives a continuous, accurate check that spots inefficient filters, yet prevents waste through premature replacement.

The Dwyer measures filter efficiency the only practical and economical way—via pressure drop. Quickly pays for itself through savings in replacement and service time and greater operating efficiency.

Break-proof plastic construction, lifelong accuracy, simple installation, no moving parts to ever wear out or get out of adjustment. Ranges 0-½", 0-1", 0-2" and 0-3" water. A complete unit with all necessary tubing, fittings, etc.

Write for Bulletin C10

F. W. DWYER MFG. CO.

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Houston's Welcome to the World . . . The beautiful Rice Hotel has been enlarged, redecorated and refurbished, making it one of the nation's truly great hostelries. Let the *new* Rice, with all its new luxuries and conveniences, be your host on your next visit to Houston, Texas.

compressor units and related equipment. A lower structure adjoining the main building houses the control room, offices, washrooms, and emergency generator room.

All recording and indicating instruments are contained on a central wall panel. A single operator,

Night view of new $2½ million gas compressor plant for the Long Beach Gas Department is sixth in system.

seated at a modern console, can operate the entire plant automatically through the use of pneumatic type control equipment. Valves located throughout the city's entire distribution system can be remotely operated from the central control point. The new compressor station has attracted nationwide interest on the part of city planners.

Swarthmore's New Science Building

The new Pierre S. du Pont Science Building was dedicated at Swarthmore College on April 23. Designed by architect Vincent G. Kling, the new building features four distinct units organized around a central open courtyard. Both physics and chemistry departments have their own two-story rectangular units, complete with laboratories, classrooms, and faculty offices. A square one-story unit supplements the main library and houses the engineering library along with the collections of the three science departments. The link between this unit and the chemistry unit will house mathematics faculty offices. A 200-seat lecture hall, with adjacent rooms for the preparation of demonstrations, completes the building complex.

Consultants on the project were Allabach and Rennis, structural engineers; and Pennell and Wiltberger, mechanical engineers. The structural design features boldly exposed reinforced concrete columns and beams on the outside and in most interior spaces. Insulated precast concrete wall panels are designed with rugged surfaces of exposed aggregate. ▲▲

C & P Telephone Company of West Virginia Dialed "C" for CONSTANT COMFORT CONDITIONS

This exposed view shows a Kno-Draft circular diffuser tied into the ductwork.

The combination air diffuser-loudspeaker offers functional and design advantages . . . both the sound source and the diffuser occupy the same strategic ceiling location.

Greife & Daley, *Architects* • McNeil & Baldwin, *Engineers* • Riggs Distler Company, *Contractors*

. . . in their handsome new office building, Charleston, West Virginia

Type KP (overlap) diffusers complement essentially recti-linear pattern of certain areas.

Commonly these days, business and industry call on leaders like Connor to provide new or remodeled buildings with modern interior atmospheric comfort that matches the modernity of architectural design.

Here in this new 4-story office building, for example, more than 800 various Connor units have been entrusted with the 'round-the-calendar job of giving the Telephone Company's employees a comfortable climate in which to work. In addition to producing effective air distribution, the Kno-Draft squares and rounds—with their clean, simple lines—blend neatly with the building's interior . . . and 230 Kno-Draft loudspeaker diffusers enable installation of both communication and comfort sources in the same strategic ceiling locations . . . just one installation hole for two separate, vital functions.

Seeking proper design and perfect function, architect, engineer, and contractor can choose confidently from the Kno-Draft line . . . can be sure that his choice will have the others' approval and will delight the client. Write for complete information.

CONNOR . . . for Constant Comfort Conditions

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CONNOR ENGINEERING CORPORATION

kno·draft® air diffusers

Scraps & Shavings

Leased Lighting Available

For clients short of capital, consulting engineers now can cut initial investment costs by making use of leased lighting. Smithcraft and General Electric Credit Corporation are working together on a plan which will allow the installation of modern fluorescent lighting in old or new buildings on a five-year rental or time-payment basis. The total contract can be as low as $1250, with no upper limit.

Underground Parking for Topeka?

The Massachusetts Mutual Life Insurance Company, principal holder of bonds used to finance two existing Topeka parking facilities, has approved the consulting firms of Wilbur Smith and Associates and Coverdale and Colpitts to conduct a study to determine whether an underground garage could retire bond debt.

New Contract Form Available

The 1960 edition of the "Suggested Form of Contract for Use in Connection with Engineering Construction Projects" is now available. Prepared jointly by the American Society of Civil Engineers and the Associated General Contractors of America, it carries new sections on changed conditions, extension of time, responsibility for work, partial completion and acceptance, damage claims, and acceptance and final payment. The new form is available at 25 cents per copy from either ASCE or AGC.

New Formed Steel Specs

The 1960 edition of "Specifications for the Design of Light Gage Cold-Formed Steel Structural Members" is now available from the American Iron and Steel Institute, 150 East 42nd Street, New York 17. The new volume reflects research conducted since the publication of the 1956 edition. An important revision is the increase from 18,000 to 20,000 psi for the basic design stress of steels having a yield point of 33,000 psi. Several other revisions are directly related to this specific change.

Hawaiian Highway Boom?

With the transition from territory to state, Hawaii has established a State Department of Transportation which will coordinate highway, airport, and harbor developments. A $250,000 study has been authorized for general planning purposes in these three areas. It will culminate in recommendations to the 1961 legislature for a program of capital improvements based on Hawaii's needs as projected to 1980.

Summer Study Programs

Case Institute of Technology will offer two summer courses of interest to consulting engineers and architects. Dr. John B. Scalzi will offer a course in plastic design in steel from July 11 through 15, and a course on thin shell concrete structures from July 18 through 22.

More Cement for India

Kaiser Engineers Overseas Corporation has been awarded a contract to provide technical services in connection with the engineering and construction of a $3.5 million portland cement plant. The 100,000 ton per year, dry process plant will be built by Mysore Cements Ltd. at Ammasandra, Mysore State, India. It is scheduled for 1961 completion.

News of Foreign Projects

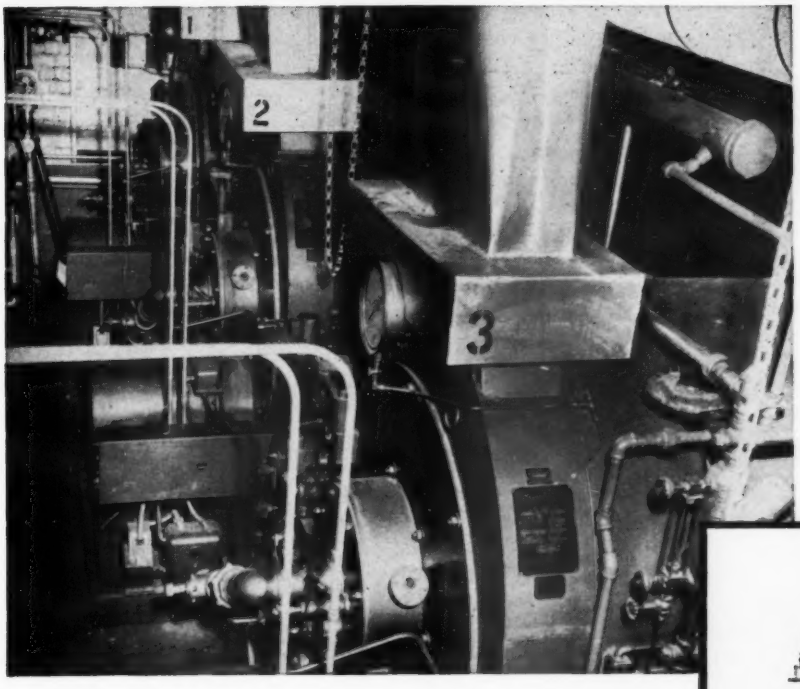
Consulting engineers interested in overseas projects will find the *Foreign Projects Newsletter,* P. O. Box 2311, Van Nuys, California, of interest. The monthly publication concentrates on construction and industrial activities that effect the U. S. position abroad, but does not attempt to cover foreign trade as such, sales of equipment, materials, and supplies. It reports major requests for proposals, contract awards, and events in the planning stage.

Piping Flexibility Analysis

Computer analysis of piping flexibility now can be provided within 48 hours by The Service Bureau Corporation. Clients need only prepare a simple description of their piping system on special data sheets. This information is punched into IBM cards and processed in a computer, normally on a 12-hour cycle. Reports include anchor and restraint reactions, forces, moments, and stresses at all intermediate points, as well as displacements and rotations. Since coordinates are not used in the input data, changes to a system are easily specified.

Belgian Congo Road Loan

A $28 million loan by the World Bank to the Belgian Congo government will be used for improving and expanding its transportation facilities. An additional $7 million is earmarked for development of agricultural productivity, and a

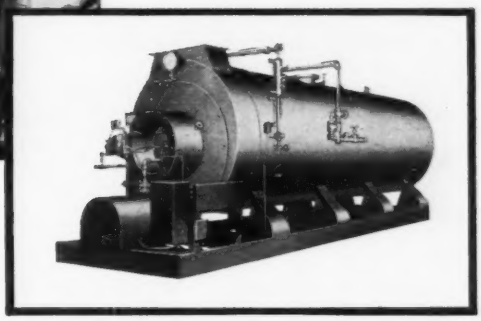


HERCULES-GALION PRODUCTS, Inc., Saves $15,000 Per Year!

Hercules-Galion Products, Inc., of Galion, Ohio, makers of dump truck bodies, ready-mix concrete truck equipment, and steel burial vaults, retired two old style boilers.

To improve heating efficiency, they installed three Cyclotherm 125 h.p. combination light oil/gas package steam generators. The total savings per year comes to $15,000.

As growing production or expanding plant facilities require more steam, Cyclotherms can be added when needed.



CYCLOTHERM

Steam capacity that grows with the plant!

When you recommend Cyclotherm Steam Generators you recommend a steam source that can be quickly and economically expanded to meet plant expansion. For Cyclotherm's wide range of capacities permits the addition of exactly as much new capacity as may be needed at any time. Will 518 lbs. of steam per hr. suit the requirements? That's what a 15 HP Cyclotherm produces. Or are 25,875 more steam lbs. per hour wanted? In that case, a 750 HP Cyclotherm fills the bill. And between these extremes there are sixteen intermediate sizes to choose from.

Compact Cyclotherms are also kind to boiler room space — the Cyclotherm is up to ⅓ smaller than the ordinary package boiler. Installation is easy—no costly stack, no excavation, no foundation. The Cyclotherm is shipped complete — ready to operate. Burner and boiler are built together to work together with *one* manufacturing responsibility back of the entire unit.

Cyclotherm's Cyclonic Combustion guarantees a minimum of 80% efficiency. Larger units operate at from 30% to 100% of rated capacity with no loss of efficiency. Smaller units operate on and off automatically according to load requirements. With simpler design and fewer parts, Cyclotherm reduces maintenance costs by from 30% to 50%. Cyclotherm's world-wide service organization gives prompt service on every call. For full information, write us today.

There are 18 Cyclotherm models, ranging from 15 HP to 750 HP. Burns oil and/or gas. The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters' Laboratories, Inc. Guaranteed against any defect in materials or workmanship. Cyclotherm also manufactures a complete line of Hot Water Generators in 10 capacities, from 670,000 BTU per hr. to 6,700,000 BTU per hr.

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Please send me your booklet *Cyclotherm Cyclonic Combustion*, also rotogravure copy of *Cyclotherm Sales Steam* with illustrations and descriptions of Cyclotherm installations.

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third loan of $5 million will go to Otraco, a government agency which operates extensive rail and river transport services in the Congo.

Road projects to be financed as a part of the development program include:

¶ Construction and reconstruction of about 420 miles of paved and gravel highways.

¶ Improvement of 750 miles of existing roads.

¶ Provision of bridges and ferries.

¶ Construction of 1680 miles of surfaced, single-lane roads in farming areas where settlements and cattle breeding stations are located.

Postal Rules Favor Consultants

A recent Post Office Department publication on construction requirements for leased postal facilities prescribes the use of consulting engineers and architects. Where local, county, or state laws, regulations, or ordinances require the services of a registered engineer or architect to prepare plans and specifications the regulation states, the bidder must comply.

In any event, the Post Office adds, the bidder "is encouraged to procure the services of a competent architect or engineer in all instances." Regional offices of the Department will have final authority in applying the requirement.

The complete bidders' instructions (POD Publication 39, September 1, 1959), is available from the Government Printing Office.

Nevada Irrigation District

The Nevada Irrigation District has awarded Ebasco Services a contract for the engineering and management of construction on NID's proposed irrigation and hydroelectric development on the Yuba and Bear Rivers in California.

The watershed is on the California slope of the Sierra-Nevadas and extends to the region of the Donner Pass.

The District proper and its irrigated areas are in the lower foothills in the "Mother Lode" region which was so productive of gold during the gold rush days.

The project will consist of two storage reservoirs, Jackson Meadows and Rollins; two power plants, Dutch Flat No. 2 and Chicago Park; the raising of Lake Faucherie in the high Sierras; and other improvements. Installed capacities will total 61,700 kw, and annual energy will be approximately 236 million kwh. It is anticipated that construction on the $40 million project will start early in 1961.

Toll Roads Pay Their Way

According to Lawrence S. Waterbury, toll roads need time and promotion to build up sales — just like any other business. Only two are now in serious trouble, the West Virginia Turnpike and Chicago's Calumet Skyway. The Ohio Turnpike earned 1.71 times its interest charges in 1959 compared to 1.52 in 1958. Even the Northern Indiana Turnpike earned 1.08 times interest in 1959, in spite of the steel strike and bad weather.

Waterbury contends that the toll road is one solution to current highway needs which are not being met by the Interstate Program. His contention that toll road financing must be considered on a long term basis is born out by the Pennsylvania Turnpike which is presently clearing 6.51 times its annual interest charges. Even the Kansas Turnpike, off to a slow start, is showing steady gains and will probably pay its way in 1960.

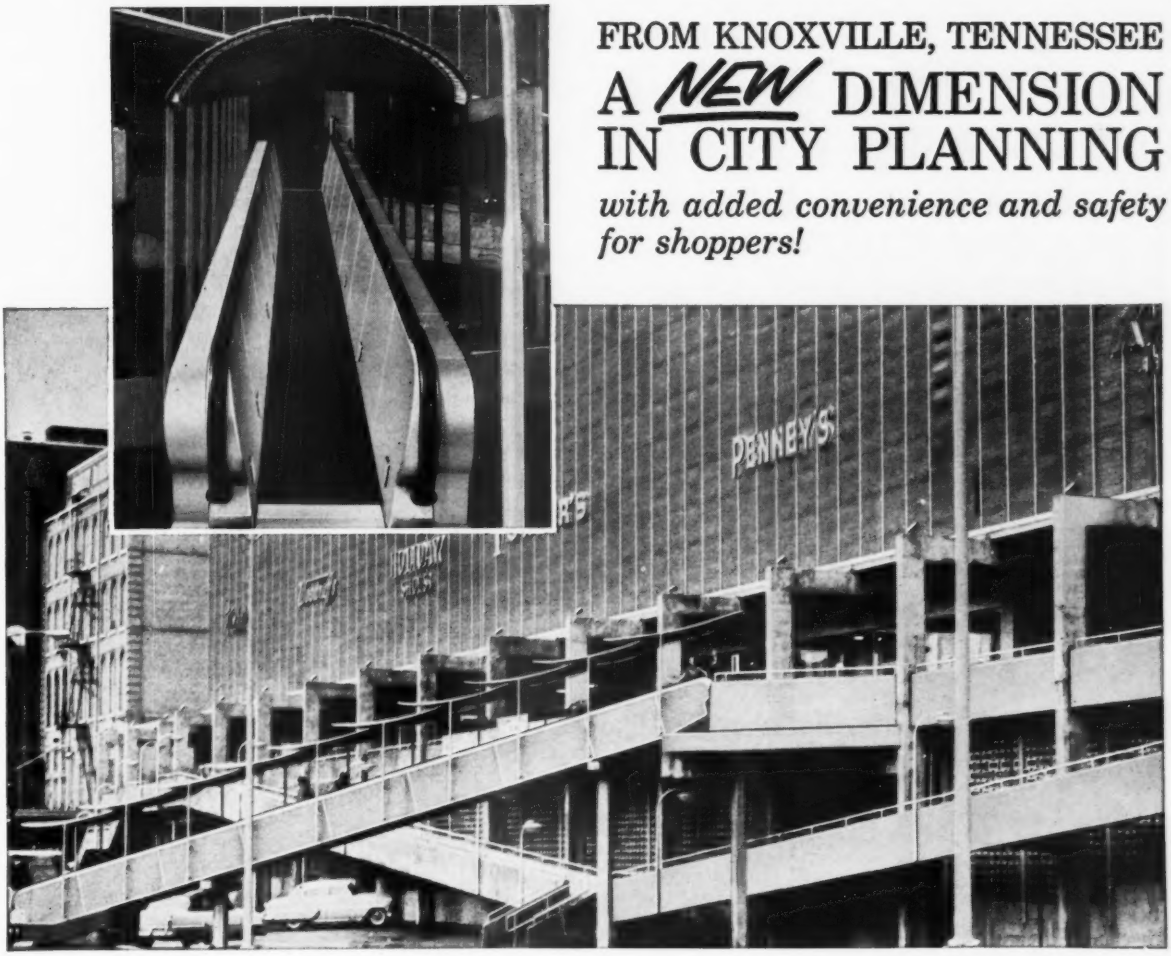
Record School Construction?

City Schools Superintendent, John J. Theobald, has recommended a record school construction and capital improvement program, providing for the expenditure of $124,350,000 in 1961, to the New York City Board of Education. The program would provide for the completion of 181 major school projects.

Columbus Freeway Plans

Rackoff Associates has reported that a Columbus, Ohio, East Free-

FROM KNOXVILLE, TENNESSEE
A *NEW* DIMENSION IN CITY PLANNING
with added convenience and safety for shoppers!



Stephens-Adamson SPEEDWALK and SPEEDRAMP Passenger Conveyor Systems like the one shown at the Gay Street Promenade, Knoxville, Tennessee have added a new dimension to city planning. In an all out effort to modernize and beautify their stores, the merchants and property owners of Downtown Knoxville in cooperation with the Downtown Knoxville Association, Inc., have combined their efforts and ingenuity in the planning of the over one half million dollar Knoxville Promenade and Parking Plaza. Pedestrian shopper traffic now moves smoothly with added convenience and safety of SPEEDRAMP Passenger Conveyor Systems from Parking Plaza to the Promenade area. A colorful canopy protects shoppers from the weather. Passengers are carried up a 15 degree incline.

SPEEDWALK and SPEEDRAMP Passenger Conveyor Systems provide for greater economy—20% to 30% less initial cost than "Moving Stair" type conveyances. Simplicity of construction and less moving parts assure less "downtime" and lower maintenance cost. Utilizing exclusive Stephens-Adamson safety features, SPEEDWALK and SPEEDRAMP Passenger Conveyors are unmatched for convenience, safety and economy.

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Lowest Silhouette Design

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Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE SIZES 10"-72" 600-47,000 CERTIFIED C.F.M. RATINGS

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way would cost $30 million, an increase of $10 million over previous plans. The increase resulted from a 1959 origin and destination survey which indicated a need for six lanes instead of the intended four. The consulting firm's report is being reviewed by city, state, and Federal officials, and construction is not expected before 1964.

Highway Program Birthday

July 1 marked the fourth anniversary of the effective date of the 1956 Highway Act. The Better Highways Information Foundation will use the occasion of the fourth birthday of the accelerated highway program as an occasion for publicizing the tremendous progress that has been made.

BHIF Gets Organized

At a recent meeting in Washington, the Better Highways Information Foundation named George M. Foster executive director. Presently executive director of the Indiana State Highway Department, Foster will assume his new responsibilities in Washington in the near future. At the same meeting, H. D. Anderson, past president of the Associated Equipment Distributors, was elected vice chairman of the Foundation. A distinguished national leader will be named as chairman in the near future.

Lightning Losses Rise

According to the Lightning Protection Institute, lightning losses in dollars is mounting at the rate of about 10 percent per year. The growth and spread of lightning losses parallels the growth and spread of plants, factories, homes, and community facilities to suburban and outlying areas. It is in these areas that lightning causes 37 percent of all fires.

San Juan Expressway Contract

The Commonwealth of Puerto Rico, Department of Public Works has awarded a contract to the firm of Lockwood, Kessler & Bartlett, Inc. for the design of the major portions of the proposed San Juan urban arterial system. Construction costs currently are estimated at $18 million for limited access highways and bridges. The consulting firm is planning to enlarge its Puerto Rico office, which opened last summer.

New Airport Location

A report submitted to the city of Columbia, South Carolina by the engineering firm of Leigh Fisher and Associates recommended the construction of a new $5 million airport, four miles from the city's present airport. It was suggested that the city join with two counties in an effort to obtain state forest land for the new airport. A portion of the construction cost would be obtained by the sale of two existing airports.

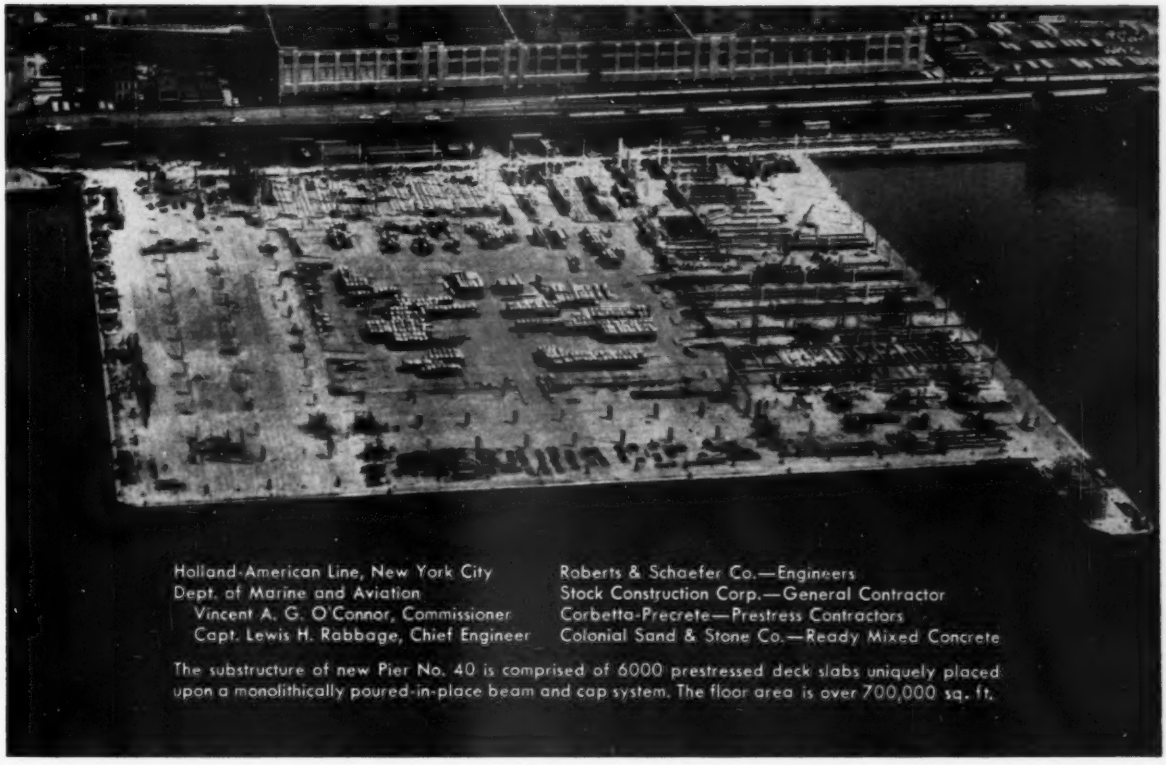
Soviets Shift Power Policy

With plans for atomic power plants reduced by half, the Russians are planning to get construction under way on the world's largest hydroelectric plant next year. The dam will be built on the Vakhsh River, at Nurek, Tadzhik SSR. It will have a capacity of 2.5 million kw, 400,000 kw more than the huge Lenin hydro plant on the Volga.

In its race to overtake the U. S. in per capita power production, the Soviet has suddenly become aware of past blunders. For example, it has been estimated that several thermal power plants could have been built for the same amount invested in the Lenin plant — and capacity would have been five times as great.

Of the 40 large power stations currently under construction in the USSR, 28 will have a capacity of 1 to 2 million kw each. They will be equipped with turbogenerators of 200,000 up to 600,000 kw each, with the emphasis on the larger units because of significant cost reductions. In addition to these large stations, it is planned to build 17 large gas power stations during the current seven-year plan. ▲▲

Controlled Concrete with
SONOTARD
for New York's Largest Pier now under construction



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The substructure of new Pier No. 40 is comprised of 6000 prestressed deck slabs uniquely placed upon a monolithically poured-in-place beam and cap system. The floor area is over 700,000 sq. ft.

• **SONOTARD** is being used in *all* concrete to produce consistent and uniformly high strengths required for the heavy live loads to be handled, plus maximum density to resist erosion from sea water.

• A high degree of workability to facilitate placement has been maintained through high summer heat and a winter which recorded a low mark for sustained cold weather.

• The quantities of **SONOTARD** used were varied according to temperature to keep the water content and rate of hardening constant. At all temperatures **SONOTARD** produced a uniformly high strength with maximum density and eliminated shrinkage and cracking.

• **SONOTARD** played an essential role in the prestressed deck slabs and beams by controlling the initial rate of hardening and fluidity of concrete for optimum placement properties.

• **SONOTARD** speeded the strength development (15 hours of steam cure averaged over 4500 psi) permitting early release of tension and early stripping of forms.

• Since **SONOTARD** does not increase the air content while reducing water requirements it allows the operator to control accurately the total air at all times.

Consult your local SONNEBORN representative for your particular project to learn how **SONOTARD'S** exclusive formulation can help you produce harder, denser floors—more uniform, crack resistant structures—water-tight concrete of minimum shrinkage.

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Company.....

Address.....

City.....**Zone**.....**State**.....

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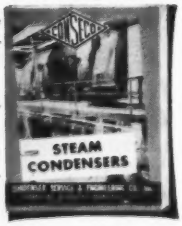


Consulting Engineers' Calendar

July 6-8. American Society of Civil Engineers, American Society for Engineering Education, Cooper-Union, co-sponsors; Conference on Civil Engineering Education, University of Michigan, Ann Arbor, Michigan.

July 10-22. Pennsylvania State University; Seminar on Atomic Shelters (architectural and engineering planning aspects), Campus.

Aug. 15-17. American Society of Mechanical Engineers and American Society of Chemical Engineers; Heat Conference and Exhibit, Statler Hilton, Buffalo, New York.

Aug. 17-19. American Society of Civil Engineers; Hydraulics Conference, University of Washington, Seattle.

Sept. 8-9. American Society of Civil Engineers; Conference on Electronic Computation, Hilton Hotel, Pittsburgh, Pennsylvania.

Sept. 15-16. American Society of Mechanical Engineers; Engineering Management Conference, Hotel Morrison, Chicago, Illinois.

Sept. 25-28. American Institute of Chemical Engineers; National Meeting, Hotel Mayo, Tulsa, Oklahoma.

Sept. 26-30. Instrument Society of America; Fall Instrument-Automation Conference & Exhibit, Annual Meeting, Coliseum, New York, N. Y.

Sept. 27-30. Prestressed Concrete Institute; 6th Annual Convention, Statler-Hilton, New York, N. Y.

Oct. 2-6. Water Pollution Control Federation; 33rd Annual Meeting, Convention Hall, Philadelphia, Pa.

Oct. 3-5. National Association of Corrosion Engineers and University of California; Corrosion Short Course, San Francisco, California.

Oct. 3-5. National Association of Corrosion Engineers and University of Oklahoma; Corrosion Short Course, Campus, Norman, Oklahoma.

Oct. 5. Society of Plastics Engineers, Inc.; Technical Conference — "Plastics vs. Corrosion," Mark Hopkins Hotel, San Francisco, California.

Oct. 10-14. American Institute of Electrical Engineers; Fall General Meeting, Chicago, Illinois.

Oct. 10-14. American Society of Civil Engineers; Annual Convention, Hotel Statler, Boston, Massachusetts.

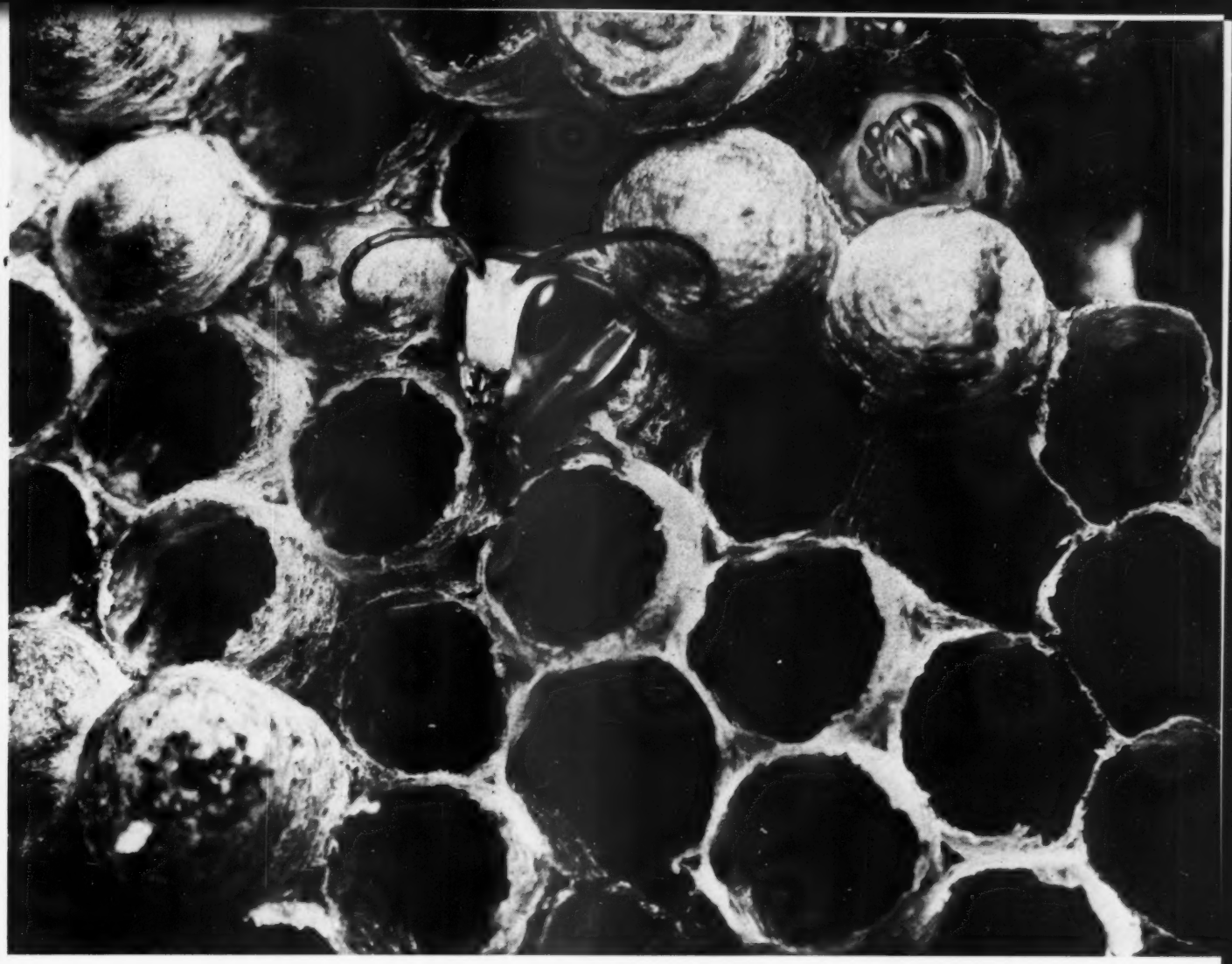
Oct. 25. Association of Consulting Chemists & Chemical Engineers, Inc.; Annual Meeting and Symposium — "The American Consultant Outside USA," Hotel Shelburne, New York, New York.

Nov. 14-17. National Warm Air and Air Conditioning Association; 47th Annual Meeting, Cleveland, Ohio.

Nov. 15-16. Purdue University; Symposium on Engineering Applications of Probability and Random Function Theory, Campus, Lafayette, Indiana.

Nov. 15-17. Building Research Institute; Fall Conferences, Shoreham Hotel, Washington, D. C.

Nov. 27-Dec. 2. American Society of Mechanical Engineers; Annual Meeting and 24th National Exposition of Power and Mechanical Engineering, Statler-Hilton, New York, N. Y. ▲▲



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ACF Industries, Incorporated —W-K-M Division ..... 3rd Cover
Acme Industries, Inc. 160-161
Adams Co. Inc., R. P. 132
Advance Transformer Co. ..... 2nd Cover
Aget Manufacturing Co. 196
Alco Products Co., Inc. 3
Allen-Bradley Co. 169
Allis-Chalmers 17
Alloy-High Strength Div. of U. S. Steel Corp. 82-83
Altec Lansing Corp. 14
American Bridge Div. of U. S. Steel Corp. 207
American Engineering Co. 77
American Gas Association 189
American Standard Industrial Div. 12, 35, 36, 37, 38
American Steel & Wire Div. of U. S. Steel Corp. 104-105
Ammerman Co., Inc. 204
Armco Drainage & Metal Products, Inc. 52
Autocall Co. 150

Bell & Gossett Co. 50
Blonder-Tongue Laboratories, Inc. 162
Borden Metal Products Co. 71
Bros Incorporated 158
Buell Engineering Co., Inc. 151
Buffalo Forge Co. 45
Burt Mfg. Co. 78
Bussmann Mfg. Div., McGraw-Edison Co. 10-11
Butler Mfg. Co., Buildings Div. 47

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Electromagnetic Interference Studies
Francis Palms Building, Detroit 1, Michigan

Carrier Corp. 184
Certified Ballast Mfgrs. 63
Chalfant Products Co., Inc. 46
Chesapeake and Ohio Railway 24-25
Clarage Fan Co. 67
Clyde Iron Works, Inc. 56
Committee on Steel Pipe Research 163
Condenser Service & Engineering Co., Inc. 206
Connor Engineering Corp. 199
Couch Co., S. H. 127
Crane Co. 54
Curtis Manufacturing Co., Refrigeration Div. 171
Cyclotherm Division of Crane Co. 201

Darling Valve & Mfg. Co. 41
Detroit Stoker Co. 145
Diamond Power Specialty Corp. 79
Dracco Division of Fuller Co. 167
Dravo Corp. 44, 197
DuKane Corp. 22
Dur-O-waL Products, Inc. 139
Dwyer Manufacturing Co., F. W. 198

Edison Industries, Thomas A. Instrument Div. 81
Electric Storage Battery Co. 40
Elgin Softener Corp. 155
Enjay Chemical Company A Division of Humble Oil & Refining Company 32-33

Fisher Governor Co. 15
Flintkote Company, The (Orangeburg Division) 20

General Cable Corp. 159
General Electric Co. 146-147, 209
Globe Co., Products Div. 193
Granco Steel Products Co. 48-49
Guth Co., The Edwin F. 74

Halliburton Co. 4
Hotel Mt. Lake 176

Infilco Inc. 21
Inland Steel Products Co. 19
International Boiler Works Co. 66
Irving Subway Grating Co., Inc. 140
I-T-E Circuit Breaker Co. 111, 179

Jefferson Electric Co. 31
Johnson Gear & Mfg. Co. 166
Jordan Corporation 182

Kaiser Aluminum & Chemical Corp. 166, 168, 170, 172, 174, 176, 178, 180, 182
Kalamazoo Tank & Silo Co. 178
Kaul Clay Co. 42
Killark Electric Mfg. Co. 122-123
Kinnear Mfg. Co. 60
Kohler Co. 144
Kraloy Plastic Pipe Co. 62

McPhilben Lighting Co. 202
McQuay Inc. 27
Marlo Coil Co. 61
Master Builders Co. 210
Mercoid Corp. 80
Morton Salt Co., Industrial Div. 143

Naylor Pipe Co. 177
Nesbitt Inc., John J. ..... 4th Cover
New York Blower Co. 23
NIBCO Inc. 153
Nugent & Co., Inc. 30

Orangeburg Manufacturing Co. (Division of the Flintkote Company) .. 20
Orr & Sembower, Inc. 133

Pass & Seymour, Inc. 152
Penn Ventilator Co. 181
Planet Corp. 141
Portland Cement Association 65
Powers Regulator Co. 6-7
Pratt Co., Henry 168
Propellair, Div. of Robbins & Myers, Inc. 16

Rauland-Borg Corp. 188
Recold Corp. 156
Rice Hotel 198
RLM Standards Institute, Inc. 173
Robinson Clay Products Co. 187
Rockwell Standard Corp., Grating Div. .. 18
Roebling's Sons Division, John A. The Colorado Fuel and Iron Corp. ... 175
Rome Cable Corp. 191
Roth Co., Roy E. 28

S & C Electric Co. 68-69
Sonneborn Chemical & Refining Corp. .. 205
Square D Co. 134-135, 157
Stephens-Adamson Mfg. Co., Speedwalk Div. 203
Stromberg-Carlson, a Div. of General Dynamics 43
Sumo Pumps, Inc. 64
Superior Combustion Industries, Inc. 149
Surface Combustion, a Div. of Midland-Ross Corp. 142
Sutorbilt Corp., Subs. of Fuller Co. 194

Tapecoat Co., The 170
Tex-Vit Supply Co. 190
Thompson Electric Co. 138
Torit Mfg. Co. 174
Tranter Mfg. Co. 137
Trerice Co., H. O. 196

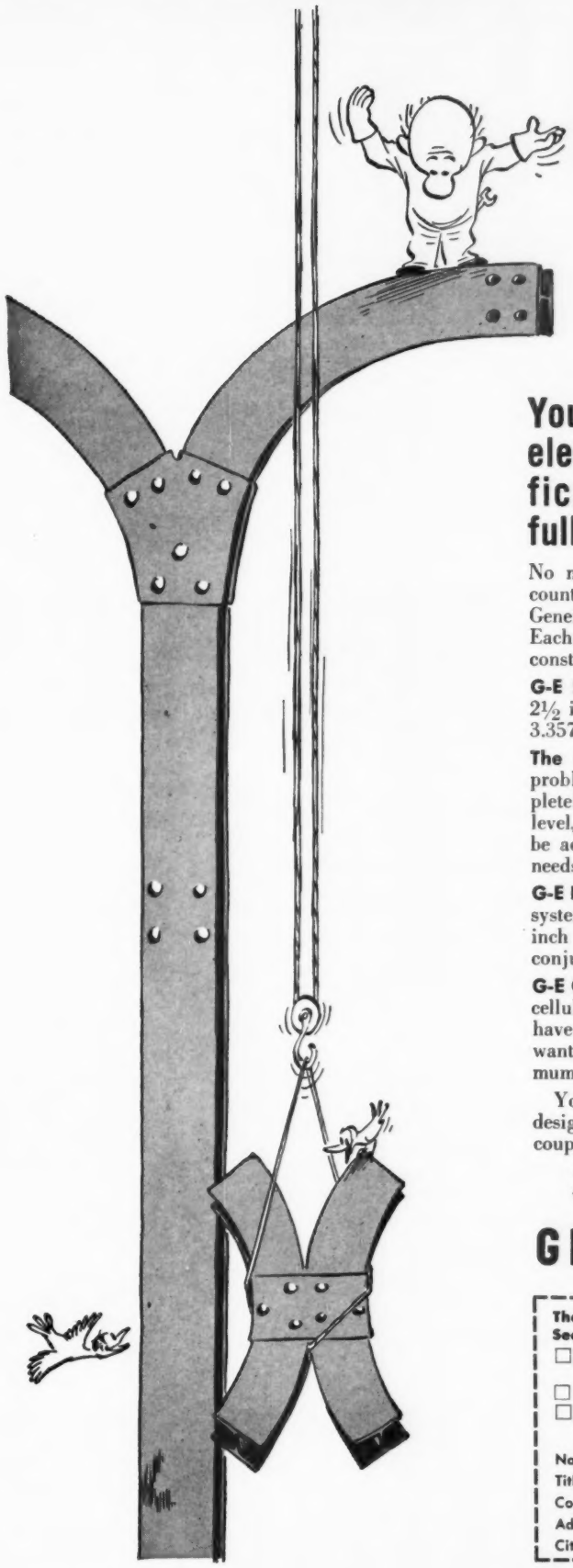
Union Asbestos & Rubber Co. 9
U. S. Steel Corp.
Alloy-High Strength (Joint) 82-83
American Bridge 207
American Steel & Wire 104-105

Viking Pump Co. 172

Wallace & Tiernan, Inc. 192
Weinman Pump Mfg. Co. 76
Westinghouse Electric Corp. Distribution Switchboards . 53, 55, 57, 59
Wheeling Corrugating Co. 72-73
Wheelock Signals, Inc. 29
Williams Equipment & Supply Co. 182
W-K-M Div. of ACF Ind., Inc. ... 3rd Cover

Yarnall-Waring Co. 85

Zenith Electric Co. 186
ZURN INDUSTRIES, INC. Plumbing Products Div. 183



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CONCRETE PERFORMANCE REPORT:

POZZOLITH concrete used in the Tri-Dam Project to meet full range of engineering requirements for all types of concrete specified... saves $86,000 in costs of concrete alone

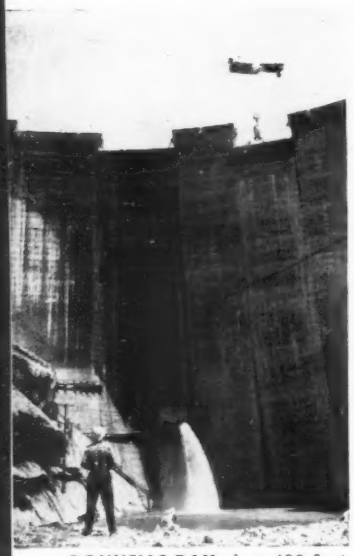
TULLOCH DAM stretches nearly 1/3 of a mile across the Stanislaus River. Here POZZOLITH Retarder proved particularly benefical in mass concrete during summer months when the temperature soared to 110°F.

TRI-DAM FACILITY is jointly owned and operated by the Oakdale and the South San Joaquin Irrigation Districts, California. Design Engineers: George T. Goodall Co. & International Engineering Co., Inc. • Project Engineers: Tudor-Goodenough Engineers • Contractors: Donnells Dam and Beardsley Dam—Tri-Dam Contractors (a joint venture by Morrison-Knudsen Co., Peter Kiewit Son's Co., Macco Corp., and Stolte, Inc.); Tulloch Dam—The Arundel Corp. and L. E. Dixon Co.

TRI-DAM PROJECT

The Tri-Dam Project in south-central California is one of the most interesting hydraulic programs undertaken in recent years. Each of the three structures represents a different basic type of dam being constructed in North America today.

Donnells Dam is a graceful concrete arch. Tulloch Dam is a concrete gravity structure and Beardsley Dam a rolled earth dam with a concrete spillway.



DONNELLS DAM rises 480 feet above foundation. This project included construction of a 7-mile long concrete-lined tunnel, penstock and powerhouse.

Evaluation Tests—approximately 16,000 yards of plain concrete had been placed at Tri-Dam when laboratory tests and field trials showed that mixes made with POZZOLITH Retarder would lower the rate of temperature rise in the mass concrete. By permitting the use of lower cement factors for the same strength, the use of POZZOLITH also reduced the total heat evolved and provided other basic improvements in quality. It was decided to employ POZZOLITH in the balance of the 500,000 cubic yards to be placed.

A wide range of mixes was used at Tri-Dam and ambient temperatures varied from 110° to below freezing. POZZOLITH aided the placing operation in all situations encountered. Strength and other performance requirements were met with important savings in cost of concrete—savings of $86,000 on the entire project, according to cost records.

Throughout the project, Master Builders field men assisted in solving on-the-job concrete problems . . . adding their experience and know-how to that of Tri-Dam Project engineers, contractors and concrete suppliers.

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BEARDSLEY DAM—an earth fill dam with concrete spillway. The structure is 1,000 ft. long and 280 ft. high.

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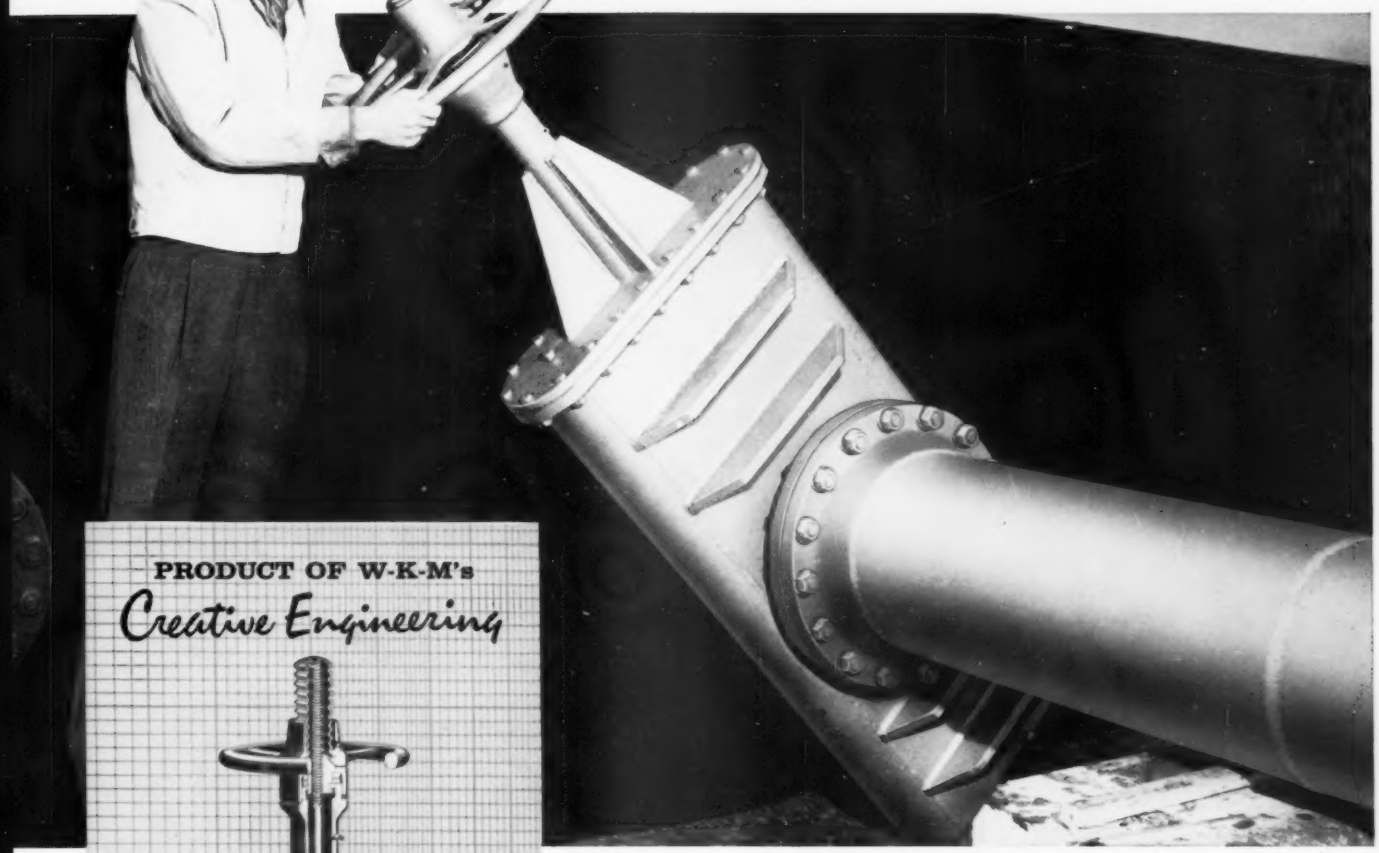

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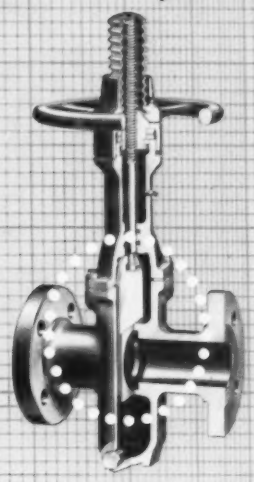

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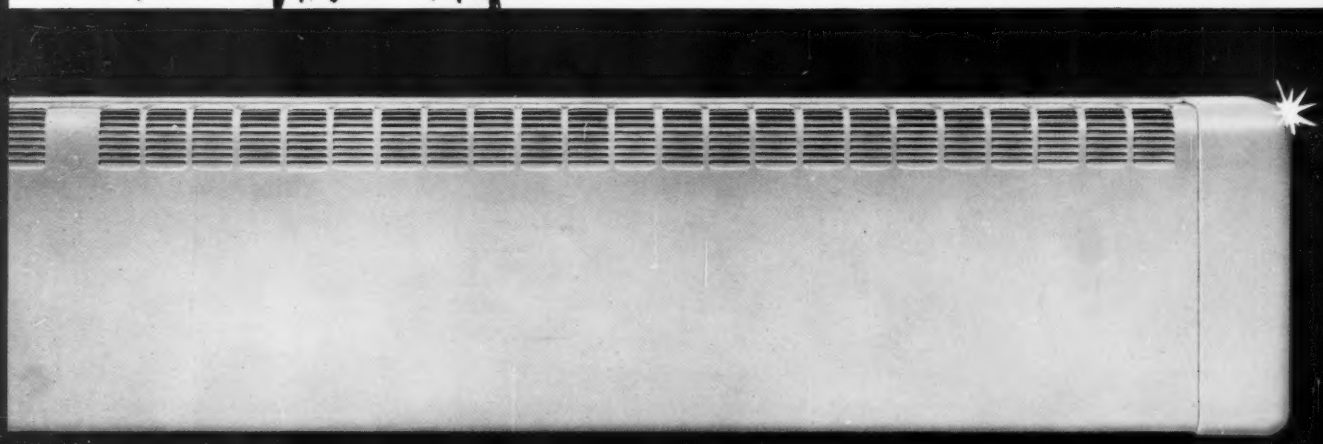

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All accessories are expensively die-formed to compliment enclosure design and fit perfectly	✓
Eight-step rust-inhibited baked enamel finish in a choice of six modern decorator colors	✓
Seven stock lengths of enclosure and heating element; any wall-to-wall fit without cutting	✓
Ten types of steam-or-hot-water fin-and-tube heating element; and four types of electric	✓
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Add Nesbitt's baked enamel finish — flawless result of an 8-step process under strict inspection.

Compare all the Nesbitt features with any others! Remember, like Confucius say: "Chinese copy cost less, worth less, is less. Take real thing, take Nesbitt!"

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You write us . . . he come, chop chop!

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